AMERICAN
DYESTUFF REPORTER

VOLUME XXIII | OCTOBER 8, 1934 | NUMBER 21

A Recent View of

Direct Dyeing

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A study of the literature of the direct dyeing of cellulose discloses at once that there are under development several somewhat dissimilar lines of thought. Most of the main points may eventually harmonize in the final true explanation of the mechanism of direct dyeing. This article is mainly a review of several recent publications pertinent to one of these divisions of thought, the original papers being partly in journals which are not widely available.

OFF-HAND, it may not seem that any of the work on the theory of dyeing could change the present well established general practice to any extent. The man in the dyehouse has found ways of getting most of his work out in a reasonable time and with acceptable uniformity. However, one who studies such work critically, either in the dyehouse or the laboratory will find that there are unexplainable peculiarities in the behavior of dye formulas, and unaccountable troubles as well as the far greater proportion of excellent results. In the course of the present writer's experience in dyeing a number of types of cellulose fibers in several textile mills it has seemed over and over again that our real knowledge is woefully lacking even though our experience is such that we can get results.

In the continual search for help from the theory the writer has paid particular attention to recent research by British workers which seems to be included in the most fundamental of the great amount that is being published. While it is not nearly complete it presents some rather new views which are a little difficult to understand and to accept but which must apparently be correct.

This work also brings out the differences in the dyeing behavior of individual dyestuffs which are probably much greater than commonly appreciated. These differences do not appear in ordinary routine laboratory tests; and they are obscured in the dyehouse by the use of compound shades and by the necessity of accommodating the method of dyeing to individual dyes that occur in the formula. By the time we have made allowances because we have to use a few dyes for which there are no substitutes, and have put in a few "bad-working" colors because those that we would prefer to use are not fast enough, the chance of utilizing the theory or introducing any system begins to seem somewhat remote.

This rather lengthy introduction has hardly turned out to be a sales talk on the value of theories of dyeing, but the difficulties of the problem make any help in their solution all the more valuable. While not enough of the idiosyncrasies of individual dyes will be discussed here to be of much practical use it is especially suggested that such study of the ingredients of dye formulas may yield some surprises and indicate how the formulas can be handled to better advantage by simple changes in the dyes or in their manipulation.

Purity of Materials

While it is obvious to a scientist that very pure dyes should be used in a piece of research as well as very pure fibers, it is not so clear to a practical man who has to use commercial dyes which contain unavoidable harmless impurities, and commercial goods which may not be bleached or may contain foreign materials.

Purity is necessary for definiteness but cases have been described where extreme purity of dyes, water, and fiber led to very unusual dyeing results. It has been claimed that with extreme freedom from electrolytes everywhere in the system cellulose will not absorb dyes at all; and that if dyed cellulose is washed with conductivity water, the dye will come off completely as soon as all traces of salts have been removed. The work under review was not carried out at this extreme of purification.

Fibers for research should certainly be of some definable degree of purity and in some definite physical state. Too vigorous purification may change this state or make some more fundamental chemical alteration. The dyes themselves have to be pure or of known concentration because otherwise it is impossible to determine how much actual dyestuff is absorbed in any particular case. Both fiber and dye should be reproducible.

Unfortunately some objection can be found to most of the published work on the mechanism of direct dyeing, that is, to the work itself as a basis for the conclusions reached. In particular cases the time factor has not been taken into account sufficiently; or the purification of materials has not been sufficient; and much work has been based on uncertain suppositions regarding the colloidal nature of the dyes, which has been affected by impurities that were not taken into account.

Neale and his coworkers in England have recently given us a group of important papers and for reasons of convenience in observation and measurement started their work with cellophane instead of a textile fiber. While unusual, it seems to have worked out very satisfactorily, partly because the sheet form and measurable thickness lend themselves so much more readily than fibers to mathematical treatment.

This choice of cellophane as a material to dye has been justified by very definite evidence that the dyeing process is partly a diffusion. Cellophane, freed from glycerine by water washing, is substantially cellulose but it has some of the attributes of viscose rayon because it is "regenerated" and is highly "activated" as a result of swelling during manufacture. Chemically it is a somewhat degraded form of cellulose and usually shows some characteristics of oxycellulose. R. E. Rose has noted that it appears to have a superficial layer of some sort of degraded cellulose. However, such chemical changes have apparently not interfered with its use in research on dyeing.

Direct Dyeing a Diffusion Process

While this may sound odd to the dyer, one of the things that interferes with research on dyes is that the bath becomes exhausted. From the research point of view the dyeing process is simpler if the amount of dye absorbed can be measured while the concentration of dye in the solution from which it is being absorbed remains unchanged.

Part of Neale's work was planned to avoid this continuous change during the dye absorption, by the use of a relatively very small amount of "goods" which would not take out enough color to appreciably change the bath. In certain cases the amount absorbed was not more than 2 per cent of the dye present.

When the amount of dye was thus maintained at a constant concentration in the bath so that other things would not interfere with the course of the dyeing the absorptions of dye by cellophane corresponded very closely to a diffusion curve. The microscope showed the gradual penetration of color from the outside toward the center when sections of partially dyed samples were examined. Then the analysis of scrapings from the outside and inside of completely dyed cellophane showed equal dye contents, within the errors to be expected in such delicate tests. The explanation of dyeing as a diffusion phenomenon was also verified by the use of cellophane sheets of different thicknesses. Thus the utility of cellophane and of mathematical formulae for such specialized studies in determining the mechanism of dyeing was clearly shown, although seemingly impractical from the dyehouse point of view.

From all of this evidence direct dyeing is concluded to be fundamentally a diffusion process which continues up to a uniform distribution of dye throughout the thickness of the cellophane sheet. " . . . bulk movement of the dyestuff molecules through the gel is the principal factor determining rate of absorption."

Equilibrium, Salt and Temperature

Previous work in general has failed to distinguish between the effects of rate of absorption and of amount of absorption at equilibrium. Neale's group has apparently presented for the first time quantitative proof that a true equilibrium state can be reached in the absorption of dye by cellulose.

In referring to Ruggli's recent attempts to define substantivity as "adsorbability minus desorbability" Neale states that it is doubtful whether this is anything more than an effect of time, because the dyeing is completely reversible if enough time is allowed. Griffiths and Neale, therefore, express substantivity in terms of absorption at equilibrium and rate of reaching this state under suitable constant conditions.

The study of the properties of dyes in solution is usually carried out at room temperature, while most practical direct dyeing is conducted at high temperature. Hence a study of the influence of temperature on the absorption of dyes is necessary if the two are to be properly correlated.

An equilibrium state can be obtained when dyeing at any temperature under constant conditions such as have been described here but may be shifted to either direction by a change in temperature. In general a decrease in temperature causes more dye to be taken up while an increase causes the loss of some dyestuff.

For a given dyestuff the rate of approaching equilibrium depends upon the temperature, when dyeing is done at a fixed temperature rather than during heating as is frequent in commercial practice. The temperature is a chief deciding factor but at any given value the presence of, or the amount of salt is also very important. Small amounts of sodium chloride increase the absorption rate to a maximum but with further increase in salt content there is a decrease in rate. These relations have been

observed through the range from 25° C. (77° F.) to the boiling point.

While the per cent of salt on the goods is commonly used in the dyehouse and is a familiar quantity when used with known ratios of water to goods and amount of dye, it is really the *concentration* of *salt in the bath* that is the actual controlling factor as far as salt is concerned in ordinary dyeing.

The dyebath which has been rather commonly used in this research with color at the rate of 0.05 grams and salt at 5 grams per liter would correspond to 0.15 per cent dye and 15 per cent salt if goods were present in the bath in the ratio of 1 to 30.

It is somewhat difficult to keep all the relationships clearly in mind as distinguished from ordinary dyeing, and while it is desired to restrict this discussion to fairly simple general terms it is necessary to quote some figures in order to present some of the results at all.

Chlorazol Fast Red K (Colour Index 278) at 0.05 grams per liter approached equilibrium most rapidly at 25° C. with salt at 3 grams per liter, but at 90° C. with salt at 10 grams per liter. With both dyebaths at 5 grams per liter the rate of absorption was 64 times more rapid at 90° C. but the amount absorbed was much less, the absorption being 4½ times greater at the lower temperature.

In particular experiments on Benzopurpurine 4B very little dye was absorbed in the absence of salt. The absorption increased rapidly with increase in salt concentration up to the point where the dye was thrown out of solution, which was at a not very high concentration.

Increasing the dye concentration did not increase the absorption as much as a proportionate increase in the amount of salt.

Conc. in grams per L.		Absorption per cent	
Dye	Salt	Benzopurpurine	Sky Blue FF
0.05	1.	0.73	0.125
0.10	1.	0.90	0.200
0.05	2.	1.26	0.293

These figures also give a good idea of the amounts of materials involved in this work as well as the comparison of two dyes which act so differently.

Benzopurpurine diffuses at only half the rate of Sky Blue FF (Colour Index 518) but it has a much higher affinity for cellulose. The diffusion rates reach maxima at about 10 and 5 grams salt per liter, respectively.

Benzopurpurine is absorbed at equilibrium about 3 times as strongly as Sky Blue FF but requires twice as long to reach such equilibrium.

Both the slow and the rapid dyeing types show a marked decrease in the amount of dye absorbed at higher temperatures; the more rapid dyeing colors have the lower absorption at any given temperature. With dye at 0.05 grams per liter and salt at 5 grams, at the boiling point Heliotrope 2B is absorbed to the extent of only 0.066 per cent of the cellulose; Sky Blue FF a much slower absorbing color will reach ten times the amount or 0.66 per cent under the same conditions. There is increased absorption with more salt at all temperatures, as would be expected.

Examples of the absorptions of three quite different dyes are given at the concentration of 0.05 grams per liter and the amounts of salt shown, at the temperatures indicated at equilibrium.

	25°C.		100°C.	
	gram salt per l.	% dye absorbed	gram salt per l.	% dye absorbed
Chrysophenine G	2	1.00	25	0.22
Heliotrope 2B	5	0.96	5	0.066
Fast Red K	5	1.87	5	0.268

These clearly illustrate the great differences in dyestuffs. Various other data are given in the original papers.

The *rate* of diffusion into viscose sheet is roughly doubled for a 20°C. rise of temperature and the *amount* of dye absorbed is roughly halved by a rise of 30°C.

Dyes which have a high value of the diffusion coefficient penetrate fabrics readily and dye viscose rayon level.

Comparison with Cotton

Bleached Egyptian cotton behaved in a similar manner with changes of temperature. Cotton usually absorbs less dyestuff than cellophane. Equal amounts of Heliotrope 2B were absorbed by these two types of cellulose at about 95° C. Cellophane takes up more below this temperature and cotton probably absorbs more dye about 95° C. In the presence of small amounts of salt it was shown more definitely that Fast Red K was absorbed more by cotton above 90°.

Practical Aspect of the Work

In practical dyeing different dyes are affected in opposite directions, some showing an increase in absorption with rising temperature, like Sky Blue FF and some a decrease, as Chrysophenine G and Heliotrope 2B. However, it seems that all dyes are actually similarly affected by temperature change, showing a rapid decrease in the amount absorbed at equilibrium when the temperature is raised but a still more rapid increase in the rate of diffusion. These tendencies make the explanation sound rather confused. The Sky Blue FF is absorbed slowly and does not reach equilibrium, but an increase in temperature increases the rate of absorption and causes a greater amount to be absorbed in a relatively short time. With the other dyes approximate equilibrium values are obtained quickly because the dyes are absorbed rapidly. Hence raising the temperature causes less absorption on account of the tendency to strip, or to hold back in the bath if other conditions are suitable.

Stating the same thing over again for two other dyes will emphasize this important distinction.

The time allowed in practical dyeing is such that some dyes such as Fast Red K are absorbed so nearly to equilibrium that the amount on the fiber may decrease with rise of temperature. With dyes that behave like Chlorantine Green BL the dyeing is usually far from equilibrium. In such a case raising the temperature does not reduce the amount of dye absorbed as might be expected from theory because the necessary point has not been reached, but it so increases the diffusion rate that a darker dyeing results.

Apparently an understanding of such differences in behavior for the commercial direct dyes would be of great use in the dyehouse in making selections for formulas.

At any given temperature the addition of sodium chloride causes the rate of diffusion to increase to a maximum and then fall, but the absorption at equilibrium is greater when more salt is used.

Levelling Effects

In general, dyestuffs pass from cellulose into water at a rate which is of the same order as the absorption. Hence they are readily removed at high temperatures. However, the distribution in the material comes in here. If the dye is on the surface, as from rapid dyeing, it dissolves off more readily than if the same amount of color is distributed uniformly through the material, as when dyed to equilibrium.

Theoretically any direct dyed shade can be levelled by boiling if this treatment is continued long enough, and assuming that the cellulose itself is sufficiently uniform. In practice this principle is used but if too long a time is required the items of expense and damage from overworking the goods will more than offset the levelling that is obtained.

Different dyestuffs are absorbed at different rates when all conditions of the experiment, except the nature of the dye, are constant. This rate represents the property which we think of as affinity.

The supposition that the size of dye particles or micelles has some controlling influence is uncertain because there is no reliable way to measure them. Former methods are not applicable to dyes which must now be regarded as colloidal electrolytes.

Speaking in a general way, the direct dyeing of cellulose depends chiefly upon attractions between the numerous polar groups of both dye and cellulose, but the relation between structure and direct dyeing is not simple. The shapes of molecules undoubtedly determine to a great extent the groups which can approach each other closely enough to cause absorption.

Regarding the shapes of dye molecules in the sense which has had some recent discussion in the literature, it is probable that dyes can readily take up a "co-planar configuration", and possible that one dimension of the molecule must be very small. There is, however, not sufficient evidence to tell whether either long or flat molecules are most favorable. The latter might fit flat internal surfaces as well as superficial surface.

Griffiths and Neale have compared the behavior of a number of dyes containing various groups in search of the relationships between chemical constitution and dyeing properties. Molecular weights alone do not explain the variations observed. The relations are undoubtedly very complex and it is too early to generalize to any extent. There seems to be something to the view that substantivity decreases as solubility increases. Further discussion of this phase of the work is too involved for the present review.

A table of data has been abstracted to present some of the more interesting facts for various type colors. These are the results of dyeing either cellophane or bleached cotton cloth to equilibrium in baths containing 0.05 grams of pure dye and 5 grams of sodium chloride per liter at 90° C., expressed as a percentage of the weight of cellulose material dyed (with no exhaustion).

Name of Dye	Colour Index No.	Absorption per cent By Viscose	By Cotton
Congo Red	370	3.1	1.2
Benzopurpurine 4B	448	3.3	1.13
Benzopurpurine 10B ...	495	2.45	.87
Dianol Red 2B	434	2.84	1.06
Chlorazol Blue B	406	.61	.18
Chlorazol Blue 3B	477	.95	.273
Benzo Sky Blue	520	.945	.296
Naphthamine Blue 3B ..	407	.88	.37
Eboli Blue B	475	.95	.31
Benzoazurine G	502	1.45	.70
Azo Violet	498	2.25	.923
Diamine Blue AZ	503	2.10	1.24
Chicago Blue B	516	3.40	1.20
Dianil Blue G	508	.545	.256
Brilliant Azurine B	511	.990	.388

Such data obviously furnish a basis for a scientific classification of dyes according to their properties.

Where the absorption is very small the indication is poor affinity and poor fastness to washing but better penetrating and levelling power. Those which are absorbed in large quantity at equilibrium imply the opposite properties. The reviewer would assume that dyes which show similar properties in such tables as presented in this article would work well together, but evidently much more information is needed on this phase of the subject.

Chemically pure dyestuffs are as a rule absorbed by cellulose to an almost negligible extent in the absence of salts in water or fiber. The gradual addition of any neutral salt increases the equilibrium absorption value. The effects of different salts are not in accord with the "Valency Rule" or any of the other generalizations concerning the coagulation of colloids.

DYEING RAYON

At about the same time with the publication of Neale's work there appeared a report of an extensive research from a somewhat more "practical" point of view on the dyeing of rayon by direct dyes. In general there are roughly parallel observations and conclusions and anyone interested in details of the differences should consult the original papers.

It seemed best to present this part of the review as a separate section and any repetition of the same general line of reasoning will serve to emphasize the probable correctness of the views advanced.

In all of these papers the amounts of dyestuff absorbed were definitely determined by complete stripping in pyridine and colorimetric analysis of the resulting solution, a procedure which the present writer has also found very useful. The results are, therefore, all given in terms of actual amounts of dyes and not as visual or other estimates.

In dyeing viscose rayon in the laboratory as an aid to plant work C. M. Whittaker arrived at two important facts which have been stated as follows:

First, "in dyeing for a fixed time those dyes which show a maximum affinity at a low temperature are level dyeing, while those which show a maximum affinity at a high temperature (90°) are the most unlevel".

Second, "the dyeing process is more rapid at a given temperature with a level than with an unlevel dyestuff".

Rate and time are evidently important factors and a procedure that would seem to promote ordinary unlevel dyeing is favorable for dyeing uneven viscose. These several points must be explained as a part of any complete theory of the dyeing of cellulose.

Work on rayon was arranged by Boulton and his coworkers so that instead of dyeing for a given time under various conditions the time factor was also studied, or the true rate of dyeing.

Under simple dyeing conditions the fiber and bath come to a state of equilibrium and any amount from a very little to almost all of the dye may be absorbed as the case may be. This result is obtained where temperature and all other conditions except time are kept constant. Dyeing proceeds at a decreasing rate to this equilibrium. In this work the baths may have been at equal concentrations in different experiments but were allowed to exhaust during dyeing rather than being held at the initial strength throughout as in Neale's work on cellophane.

Curves for the results of experiments under these conditions correspond with a diffusion process and all seem to represent the same kinetics of dyeing with a difference only in a velocity factor.

Considering different types of viscose rayon there were great differences in the speed of dyeing but the amounts absorbed at the *equilibrium* values were about the same for all rayons.

The following table made up from the original data illustrate these points very well for two dyestuffs by means of dye absorptions and the times of "half-dyeing" or times required to reach half the final absorption. The baths were of 40 volumes with 5 per cent sodium chloride, and 0.2 per cent Chrysophenine G or 0.12 per cent Sky Blue FF dyed at 90° C. to equilibrium.

The absorption is expressed as a percentage absorbed of the applied dyestuff.

Yarn	Chrysophenine G Absorption	Chrysophenine G Half Time	Sky Blue FF Absorption	Sky Blue FF Half Time
Viscose 300/36	40	22 sec.	82	2.1 min.
Viscose 150/40	40	28 sec.	83	2.6 min.
Viscose 150/72	39	28 sec.	82	3.1 min.
Durafil 105/120	42	19 sec.	83	3.9 min.
Cuprammonium 120/90	41	1.2 sec.		8.3 sec.

Compared with the 40 and 80 per cent absorptions shown above, it may be noted that about 98 per cent of the dye was absorbed in similar dyeings starting with 0.3 per cent Benzopurpurine 4B.

It can be seen from the table that something comes in besides the ratio of surface to volume of the filaments. The high speed of cuprammonium is probably attributable to its ultimate structure. Viscose variations may depend upon differences in cross-sectional shape and upon "skin" effects. Level dyes dye more rapidly than unlevel dyes. The differences between yarns are less with level than with unlevel dyes.

Considering the process as diffusion its progress can be seen in cross-sections of yarn as the colored area creeps from the outside toward the center. Special studies showed that the dyes that diffuse most rapidly have the greatest levelling power.

In two systems which were identical except that in one all of the dye was on the fiber and in the other it was all in the bath, it was found that exactly the same equilibrium was reached showing that the dyeings were completely reversible if sufficient time was allowed.

With two dyes at the same time in one system it was found that less of either one was taken up than when present alone. There is evidently a competition for available points of attachment and a partition of the internal surface of the cellulose between the two dyes.

The variation in dyeing affinity within a single lot of good modern rayon is not great but extremes can be found between lots. In dyeing material from two dissimilar lots in the same bath one of them may take up the color much more rapidly but if both are dyed to actual equilibrium they will be equally dyed.

The time required for an unlevel dye like Sky Blue FF to reach this equilibrium is much more than that for a level dyeing color like Chrysophenine G.

C. M. Whittaker has employed two main tests for the classification of direct dyes according to levelling properties. In his "Temperature Range Test" rayon is dyed for a specified time of 30 minutes in dyebaths of fixed com-

position at various temperatures. Even dyeing colors give the darkest shades at low temperatures and uneven ones at high temperatures.

In the "Time Range Test" which is suitable for extremely uneven dyes a rapid dyeing viscose rayon of 150 denier and 36 filaments is dyed at the same time with a coarser, slower dyeing 150 denier rayon of 21 filaments. The more uneven the dye the longer the time required to color knittings dyed in the same bath to the same shade. This test depends upon the comparative diffusions of dyestuff into the two rayons. The fine filament rayon has to take up more dye in order to look as dark as the heavier filament rayon. Rapidly diffusing colors will reach equality of shade more quickly.

Unevenness in Rayon Dyeing

From the experimental work it is concluded that speed, meaning rate of dyeing, is perhaps the most important factor in using direct dyes on cellulose. Uneven dyeing of rayon has generally been considered due to a difference in dyeing affinity, and a darker dyed yarn as having absorbed more dyestuff, but it has been found, as already stated, that the *amount* of absorption of direct dyes in the sense of capacity for absorption was practically independent of the nature of the cellulose in the yarn (rayon).

Since there is no real difference in the amount of dye which the rayons are able to absorb, the difference in any case of uneven dyeing must be due to a difference in the rate at which the dye is taken up and to too short a time to reach the equilibrium value. This leads to the conclusion that any direct dye can be used on uneven material if the time of dyeing is sufficiently prolonged which, of course, is not practical.

Whether or not it is recognized or understood, the purpose of levelling agents in the bath is to cause the equilibrium to be reached more quickly.

Some of the lack of understanding of these phenomena in the past is due to the peculiar optical behavior of rayons. Coarse and fine filament viscoses known from analysis to contain exactly the same amounts of dyestuff may look very different. The coarse filament yarn will appear to be more heavily dyed, from which it has been assumed to contain more color because of a greater affinity. This is not the case, and it is merely an optical effect.

The substantivity of direct dyes is probably due to the formation of coordinated molecular compounds between the dye molecules and the cellulose molecular chains. Such compounds are not very stable, and tend to be dissociated by water and to some extent by alcohol. They tend to be less stable, for example, than the more salt-like wool dye complexes. The affinity of dye for water can be reduced by adding salt, as shown by the increase in colloidal properties when salt is added to a dye solution. The presence of salt in an absorption system (dyebath) favors an equilibrium with more dye on the fiber.

Upon entering rayon into a dyebath the outside of each filament immediately absorbs dye to equilibrium with the surrounding bath. Then dye molecules tend to move toward the interiors of the filaments by means of osmotic forces. More dye becomes deposited on the surface to maintain the equilibrium, but it in turn may migrate to the interior. These processes continue until the rayon is in equilibrium throughout with the dyebath.

The speed of dyeing is related to the ease or difficulty of migration of dyestuff molecules through the molecular pores of cellulose. The increase in speed with a little swelling indicates that the original pores may have been relatively but little larger than the dye molecules. Probably the molecules of unlevel dyeing colors diffuse through the pores much less easily than those of even dyeing colors.

Referring again to shapes of dye molecules there is some evidence from observation in polarized light of dyeings of Congo Red on ramie, that dye molecules which we think of as being long and thin are arranged in dyeings with their long axes parallel and may, therefore, be supposed to lie along the cellulose chains.

Bibliography

The main sources of the material which has been presented are indicated below. While comments have been added it has been the intention to present the ideas of the original authors with efforts at interpretation rather than criticism.

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Of these the third and last will probably be found of most general interest.

ANNUAL MEETING
AND CONVENTION
A. A. T. C. C.
HOTEL NEW YORKER
NEW YORK CITY
DECEMBER 7th and 8th

Oils and Stains*

By H. R. HIRST, M.Sc., F.I.C., M.I.Chem.E.

DURING the manufacture of wool fabrics, oils of various kinds are used to lubricate the fibers so that they pass through the processes of opening, carding or combing, and spinning, with minimum damage as regards their length and surface covering. The drawing and spinning processes are assisted by the oil-layer, which acts as a lubricant for the fibers and thus reduces the amount of actual physical contact of the fibers with each other.

Again, oils are used in the form of emulsions as carriers of moisture to the fibers in various processes, e.g., carding and spinning, and also for conditioning yarn, i.e., restoration of the correct amount of moisture.

In all these cases, fatty oils are employed with few exceptions, but for lubricating the moving parts of the machinery the oils used are composed largely of hydrocarbons.

Fatty oils or their derivatives, e.g., sulfonated fatty glycerides or alcohols derived from fatty acids, are used now for many purposes, e.g., as wetting-out, softening, levelling agents, etc. These oils, however, are not usually considered to cause stains, but rather to prevent them if properly applied, although care has to be taken in their selection and application.

Oil Stains

These may be divided roughly into two categories—(1) Oils which produce discoloration of the fabrics, either temporarily on undyed material, or persisting after dyeing and finishing. (2) Oils which give invisible films, and produce stains or unevenness in subsequent processes.

The words "stain" and "uneven dyeing" are used here indiscriminately, because both may have common origins, and very often one is only a special example of the other.

Those stains and uneven dyeings which are caused by hydrocarbon oils are considered first, because they appear to be the most common in practice, and less understood as regards their origin.

Lubricating Oils

Generally these are composed mainly of mineral oils. Olive oil and other glycerides are not used alone as lubricants to any extent at the present time for machine bearings. Solid greases are made from various constituents, e.g., vaseline and soaps, and lubricants for belting usually contain castor oil and rosin, while various special proprietary greases are used. Many of these solid greases, when accidentally applied to grey pieces or webbing, can cause resists on account of their high m.p. and sticky nature. These are well known, but it is the more general liquid lubricants that are discussed in this paper.

Hydrocarbon oils are derived from crude petroleum by distillation, and vary in their chemical constitution with the methods of manufacture and refining, and particularly with their source. Generally, they are mixtures of saturated and unsaturated hydrocarbons and small amounts of asphaltic compounds. Those oils which are rich in asphaltic compounds are chiefly used as fuel oils. The crude distillates thus contain asphaltic bodies and also resinous substances. These, along with unsaturated hydrocarbons, are responsible for the orange or yellow color of mineral oils.

Mineral oils can be purified and bleached by successive treatments with sulfuric acid and with caustic soda; tar and resinous bodies are dissolved, unsaturated compounds are polymerized or converted into soluble acids, and when supplemented by treatment with dry Fuller's earth, water-white oils can be obtained.

Usually, only partially purified mineral oils are used for lubricating purposes, but for fine machines and where staining is objectionable more highly purified oils are necessary, i.e., oils composed only of saturated hydrocarbons. As purification is more complete, the oil loses in viscosity and lubricating power, therefore additions have to be made to remedy this defect.

The types of stains caused by hydrocarbon oils can be explained best by giving short accounts of some of the methods used for testing and comparing such oils. A more complete account is already on record (cf. this *Jour.*, 1931, *47*, 347; 1932, *48*, 90). One of the simplest methods of testing for the presence of unsaturated and resinous compounds is by examination of the oil in ultra-violet rays. Pure, saturated hydrocarbon oils give no fluorescence, but the unpurified oils show a bluish or blue-green fluorescence more or less strongly according to the degree of purity. Fatty oils, if present, should be removed by the usual methods before testing an oil in this way.

*Reprinted from Jour. Soc. of Dyers and Col.

Fig. 1 shows the depth to which fluorescence descends in the tubes.

Fairly rough quantitative comparisons can be made by diluting an oil with petroleum ether until it matches a standard oil. More accurate methods have been proposed, e.g., that of Lunde, Kringsted, and Weidon (cf. *Angew. Chem.*, 1933, *46*, 796) whereby the absorption in ultra-violet rays is estimated by means of a Zeiss spectrograph; interesting differences in olive oils were shown, and differences in fluorescence were also noted by others. These methods are useful for examining samples of oils, but from the dyer's point of view a more satisfactory test for the staining value of hydrocarbon oils and one which gives essentially practical results, is to spot the oil on to white woolen or worsted cloth and then expose in the Fadeometer or the Fugitometer, allowing both sides of the cloth to have free access to air. The light from the arc falling on the oil-spot causes oxidation or polymerization of the unsaturated components. The oil is thereby turned a yellow or orange color, and shows on the cloth as a colored stain, the intensity of which varies with the purity of the oil or freedom from unsaturated compounds.

If ordinary semi-refined mineral oil is exposed to the electric arc or to ultra-violet radiation in thin layers for some days, a considerable bulk of dark colored insoluble matter separates out, and can be filtered and further examined.

When exposing the oil-spot on wool fabric, the maximum color change takes place in a few hours, e.g., 30 hrs. is the maximum time observed by the present author, and the depth of color depends on the degree of refinement of the oil. Known grades of oil have been examined and the colored spots retained as types; the purer the oil the less the coloration, and highly refined oils give no color.

When it is desired, however, to investigate the effect of light on oils and the manner in which it influences their behavior to dyes, the oil is spotted as before, exposed for various periods of time, and then the pattern is scoured by a standard method, rinsed and dyed. In the case of impure oils, two effects are produced. a relatively short exposure to light causes the oil to become a resist, and a lighter colored stain is produced. Longer exposure, e.g., 20-30 hrs., gives a dark-colored stain, i.e., a more intense color.

The exposure test has been found, after a number of trials, to afford a comparative estimation of the value of oils as far as their staining properties are concerned.

If such an exposed oiled pattern is scoured with soap, or strongly scoured with warm soap and alkali, or even cleansed with solvents, and dried, then laid on the surface of water, the place where the oil-spot originally existed, wets-out immediately, whereas the remainder of the fabric only wets-out slowly, thus indicating a difference in the surface condition of the wool fibers. Successive extractions with organic solvents fail to prevent this increased wetting-out power. It is not due to removal of natural oil or fat from the fiber or to the action of light on the fabric, but apparently on the fibers there is a thin layer of oxidized or polymerized oil which lowers the interfacial tension, thus causing them to wet-out more rapidly.

A short exposure of 4 hrs. produces a resist effect which is just the opposite to that obtained by longer exposure. Unexposed oil does not produce this resist effect, so that a short exposure to light has produced an oil which does not readily emulsify when scoured for 20 mins. at 45° C. in a bath consisting in every case of 0.2% soap solution and 0.1% alkali.

It is worth considering these two types of stain, because they actually happen in practice, and also it is not wise in the case of oils to try to attribute the cause of staining without careful examination, as will be shown later.

Some recent work in America by Long, Rheineck, and Ball (*Ind. Eng. Chem.*, 1933, *25*, 1086), has shown that the effect of light on drying oils in paints is to promote polymerization rather than oxidation. Drying of oil films takes place in two stages; first, oxygen is absorbed and when the molecule has reached a certain complexity, it sets or gels into a mixture of solid and liquid oil. In the second stage, the latter changes to a solid, the change being accelerated by exposure to light. The liquid oil is soluble in acetone and thus can be separated from the solid. The gelling change is not accompanied by a proportional increase in weight.

The reaction brought about by irradiation of mineral oil films in the Fadeometer appears to be complete in 30 hrs., and this action is much more rapid than that which takes place when oiled material is stored in the dark at ordinary temperatures. Roughly, 87 hrs. in the dark corresponds with 1½ to 6 hrs. in the Fadeometer, depending on the type of mineral oil. It is rather difficult to obtain precise figures as the color change varies considerably.

The general influence of atmospheric moisture on the drying of fatty oil films is that an excessive amount inhibits drying, as is generally observed in the drying of paints. There was no appreciable difference in the tests made in the Fadeometer, however, and the Fugitometer, the latter working at 75% R.H., but possibly the differences are not great enough to have a noticeable effect.

Three color effects on fabrics due to mineral oils are—(1) Yellow or brown stains on grey fabrics; (2) dark colored stains on dyed fabrics; and (3) light colored stains on dyed fabrics. They are all caused by the action of light, or in storage in the dark and with access of air. Other kinds of defects are known in practice.

Similar types of stains to those discussed above can be produced by steaming oiled patterns for 1 hr. in such a way that they come into contact both with steam and a mixture of steam and oxygen.

The visual appearances of steamed and stored mate-

rials are similar. Exposures made in the Fadeometer are much more distinct and easier for comparison (cf. Hirst, this *Jour.*, 1931, *47*, 350).

Metals

Another type of damage familiar in the hosiery trade is that represented by holes produced during bleaching with hydrogen peroxide. This fault is frequently attributed either to the presence of mineral oil or oxidized oil in the form of spots. This is not correct. It is due in fact to the presence of finely-divided metals or their oxides, which frequently accompany lubricating oil stains, derived from machine bearings of iron, brass, or similar copper alloys. The action of metals and metallic compounds in the bleaching bath has been discussed by S. R. Trotman and Gee (cf. this *Jour.*, 1932, *48*, 229). Examination of a large number of faults of this type shows that the wool fibers are damaged and exhibit what are known as brush ends (see Figs. 2 and 3). The holes are frequently surrounded with a brownish coloration, which usually responds to tests for metals.

In this case, oil is only a vehicle for the catalyst causing damage.

Speakman and Chamberlain (*Trans. Faraday Soc.*, 1933, *29*, 358) have demonstrated that high b.p. hydrocarbons are not readily scoured out of wool, and these oils exhibit a property which they designate "adhesion", i.e., a proportion of the oil adheres to wool and cannot be emulsified with the usual detergents. They also exhibit high interfacial tension, which, apart from adhesion, tends to inhibit emulsification. These authors propose the addition of small amounts of oleyl alcohol to assist emulsification, and this appears to be one of the keys to the problem.

The W.I.R.A. has also been working on this problem from a different point of view, and has produced a lubricating oil free from the usual defects, being non-staining and readily removed from the fabric by means of a weak solution of soap and alkali. It also has no secondary effect on the dyeing process.

Attempts to remove oil stains before scouring have sometimes resulted in worse stians than the original. With this procedure in view, a number of solvents were tested, by spotting fabrics with lubricating oils and then with solvents, and allowing them to dry on the fabric so as to cause the oil to spread. The fabric was crabbed, scoured and dyed and the final stains examined. Scouring before crabbing, which is not the usual practice, leaves practically no marks or only extremely faint ones. In the tests given, benzene and pyridine are very satisfactory, but curiously enough trichlorethylene gave the least satisfactory results. There does not appear to be any reason for this result, unless some acid was present which neutralized some of the residual alkali on the fabric and thus produced a local difference with a different affinity for dye.

Contamination of fabrics by lubricating oils is largely preventable, and when it does occur, at any rate in the weaving industry, it is due to unsatisfactory organization and improper guarding of lubricants.

Fatty Oils

Fatty oils alone are not used as machine lubricants to any extent at the present time, but their ability to cause stains and unevenness is quite as great as mineral oils. Fatty oils are used in the textile trade for lubricating wool fibers and are composed of fatty acids, chiefly oleic, stearic and palmitic acids, and their glycerides; greater or less amounts of linoleic acid and other fatty acids are also present. Linoleic and similar highly unsaturated acids have a great affinity for oxygen, hence when these are used in oiling wool, the resultant thin film of oil on the fibers, when stored, gives two products, viz. (1) oxidized oil and (2) polymerized oil. Both, or either of these, may be produced as they are in the form of a sticky film. If

Fig. 2—Ordinary cut wool fibers.

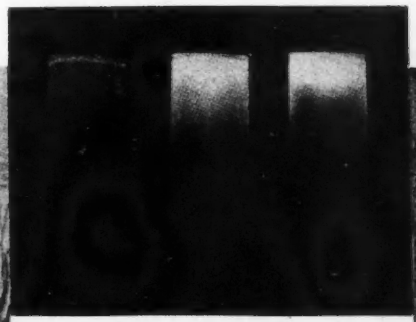
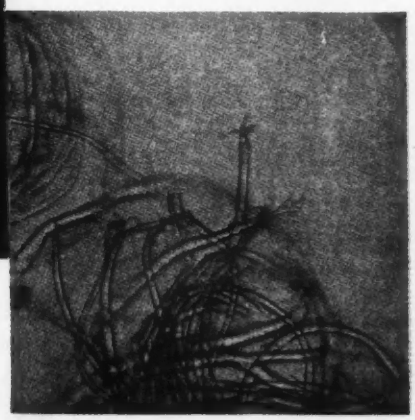


Fig. 1—Photograph of three tubes of oil irradiated by ultra-violet rays. The one on the left is highly purified oil; the middle and right hand tubes are successively less pure. They illustrate no fluorescence, fluorescence of considerable depth, and very bright surface fluorescence respectively.

Fig. 3—Wool fibers attacked by hydrogen peroxide in the presence of a metallic catalyst.



the action does not go too far, little harm is done; in fact, some spinners prefer tops to be stored so as slightly to thicken the oil and increase drag during the drawing operation. For some types of wool it is undoubtedly an advantage, but in certain cases indifferent results are obtained. Storage has other uses, however, e.g., to allow the fibers to recover from the stains produced during provessing. It is thus essential that an oil should be properly suited to its purpose. The amount of highly unsaturated fatty acids present in oils determines to some extent the danger of staining or unevenness, but the length of time which oiled material is stored is a big factor. Olive oil is very safe so long as storage is not too extended, but long-stored material mixed with new material is a fruitful source of uneven dyeing. Fortunately, however, spinners are aware of the danger of this procedure and it rarely occurs now in practice.

Uneven yarn can be produced by blending tops which have become discolored through storage with white tops, or even one top in a blend which has become stained with lubricating oil, will draw out and produce a considerable length of stained yarn. Again, oil-contaminated bobbins can produce stains which are often very difficult to trace to their source, and yarn stored in the hank is apt to stain in those portions which have greatest access to the atmosphere.

Fatty oils which have become discolored through exposure to air are readily bleached when exposed to light. This distinguishes them from mineral oils which are not so susceptible to bleaching by light. It is not always easy to interpret the results of oil analyses in terms of their suitability for textile purposes, particularly when their origin is unknown and in the case of blended oils. But, from the dyer's and finisher's point of view, the value of oil is preferably assessed in terms of more practical tests, and, when possible, dye tests. Many methods have been tried, e.g., spotting fabrics with oils and allowing them to pass through all the processes of preparing, dyeing, and finishing, whereby considerable information of a practical nature can be obtained; also dye-trials and analyses have been made on a variety of oils treated in different ways.

A number of preliminary tests were made by storing oiled wool for various periods and analyzing the oil after removal by solvents. This method, although giving certain results, is slow and useless for immediate results.

The method given for testing mineral oils has been adapted for fatty oils. White worsted is spotted with the oil, exposed in the Fadeometer for a definite period, scoured in 0.2% potash olive oil soap and 0.1% soda ash solution at 45° C. in Thermos flasks which are agitated in a shaker for 20 mins., rinsed well in running water and dyed with a suitable dye; Coomassie Blue RLE gives good contrast when used in a weak acetic acid bath. It is usual to expose the oil in the Fadeometer for consecutive periods of 3 hrs.; a good genuine commercial olive oil just shows a light-colored stain after 9 to 12 hrs. exposure. Cottonseed oil gives a distinct stain after 3 hrs. and Arachis after 6 hrs. exposure. Cottonseed oil behaves in rather a special manner. If exposed for 3 hrs. and stored in the dark, the action continues and a much stronger resist is produced. This continued effect of radiation appears to be peculiar to cottonseed oil. Cases do actually occur where such an oil has been employed, and even worse examples are not unknown.

Another satisfactory test is by *steaming* as explained previously, and valuable results are obtained as to the behavior of the stains during dyeing and finishing.

One advantage of the exposure method is that very small quantities of oils can be tested, e.g., oil extracted from fabrics. Mineral oils give a dark stain and wool grease a light stain after dyeing. Valuable information as to the nature of oil residues or stains can be obtained by spotitng on to filter paper and examining by the ultraviolet analysis lamp. Wool fat gives a white fluorescence, and mineral oils usually strong blue or violet fluorescence. The Callophane is a useful instrument for examining and comparing the fluorescence of oils and fats.

The B.T.H. Sun Lamp, which is a bulb emitting ultraviolet rays and ordinary light, is quite satisfactory for the exposure of oiled patterns, and, if they are placed close to the bulb, results similar to those obtained in the Fadeometer are given. Exposure to light reveals some interesting facts about the presence of metals in oils.

Olive oil boiled with dilute sulfuric acid and potassium bichromate becomes colored green, possibly with a chromium soap. Such a treated oil reacts with light much more rapidly than the original oil, and readily forms a stain.

Oil containing chromium reacts with some mordant dyes and becomes dyed. Such a reaction is easily possible because oil and soap residues are always present on scoured yarns and fabrics, and this action is one cause of colors rubbing. Fortunately, the amounts of oily residues are considerably reduced during dyeing. Starting with 0.8% oil residue, it sinks to 0.2% or less after dyeing.

Alizarin Red or Orange gives strongly-colored oils containing chromium lakes with chrome-treated olive oil. Other metals, especially iron, copper, and lead, act as catalysts and increase the rate of oxidation of oils.

Oleic acid, when stored in wrought-iron containers, is rapidly converted into a dark brown oil which oxidizes quickly or discolors when exposed to light. Similarly, when the oil is stored in lead-lined tanks, it dissolves some of the metal, and again the rate of oxidation is increased. It has been noticed that during the manufacture of wool fabrics when yarn comes into contact with so-called tinned iron, such as healds and gears, the fabric becomes contaminated with lead; the reason being, of course, that the "tin" is not tin, but solder consisting of 40 parts lead and 60 parts tin; solder of this type is softer than tin.

(Continued on page 577)

Carbonizing and Re-dyeing

Woolen Rags

By **S. WADEBRIDGE**

CONSIDERABLE quantities of woolen rags are being converted into shoddy and mungo by specialists firms in Yorkshire, England. In this article it is proposed to deal briefly with the processing of the rag stock so far as carbonizing and dyeing are concerned.

Carbonization of woolen rag stock is chiefly done with gaseous hydrochloric acid; spirits of salt is the more usual term for hydrochloric acid amongst rag stock converters. Only a small percentage of rag stock is carbonized by vitriol steeping, or "extracting," for in most instances this process does not destroy the vegetable matter in so efficient a manner as does gaseous carbonizing.

Rag stock is carbonized by use of "boxes" constructed on the lines indicated in the sectional sketch in Fig. 1. The contrivance consists of a container for the stock, this being enclosed within a brickwork chamber provided with flues connecting with the works chimney stack. The rag stock is loaded into a sheet iron container, H, which rotates upon the hollow axle J. The driving pulley is indicated at K. The hydrochloric acid gas is generated in an iron retort, A, which contains a heavy cast iron trough, B. This trough is strongly heated by means of the furnace, E, which is built around the retort. The liquid hydrochloric acid is stored in an earthenware receptacle, D, and the flow of acid from this is regulated by means of a faucet, L, from which the acid slowly drips into the funnel and conducting tube, C, whence it finds its way into the trough.

Contact with the hot metal immediately converts the acid into the gaseous form and the fumes then leave the retort by way of the conducting pipe, F, eventually to pass through the perforations in the hollow axle into the chamber containing the rag stock. The brick flue, I, which surrounds the chamber, H, communicates with a small side surface, G, fired with coke, and in this way the charge of rag stock is kept in a heated state. This condition is found to be indispensable to efficient carbonizing. In some plants, coke scrubbers for dealing with the spent acid and flue gas are fixed between the carbonizing apparatus and the works chimney stack.

It is customary to thoroughly dry woolen rag stock before entering it into the carbonizing apparatus. Drying of the stock is done in a hot-air stove of large capacity, the stove being situated adjacent to the carbonizing plant in order to permit of the rags being expeditiously loaded into the carbonizing apparatus while they still retain a good deal of heat acquired during drying. About one ton of stock is carbonized at a charge per machine at most plants. The gassing of the stock is of two to four hours' duration, according to the thickness of the bulk of the pieces in the stock and the stoutness of the cotton linings they contain. During this time, the coke furnaces are carefully stoked in order to maintain steady heating of the retort and flues. Excessive stoking must be avoided because the stock is apt to acquire a brownish coloration if the heat becomes too fierce.

Upon completion of gassing, the stock is discharged from the apparatus and then allowed to lie in heaps for an hour or so. Exposure to the atmosphere quickly completes the disintegration of the vegetable matter which becomes converted into fibrous dust possessed of a grayish drab color. This dust is subsequently sold for preparing

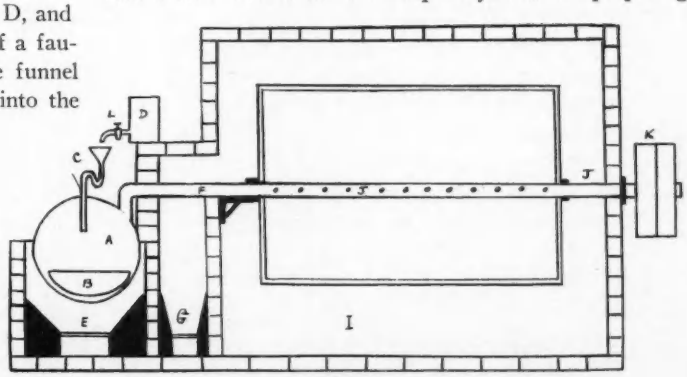


Figure 1

horticultural fertilizer. If the rag stock be examined immediately upon being discharged from the carbonizing apparatus, it will be noticed that cotton linings and so forth appear to be uninjured by the gassing operation, however, a rapid disintegration takes place after the stock has lain in heaps for a while.

Before the rag stock is ready for sorting and dyeing the disintegrated fiber dust must be beaten out. This is done in a "shaker" or a "wimsey" apparatus. Treatment in the first named apparatus is well adapted for cleansing thick and heavily milled varieties of woolen rags, the stock being drastically beaten and tossed about by the rapidly rotating arms in the interior of the machine. The "wimsey" apparatus for dust extraction is used for light qualities of stock. This machine consists of a long, slowly revolving iron cylinder enclosed in brickwork. The walls of the cylinder are pierced with numerous small holes; a number of iron rods are studded throughout the interior of the cylinder, these serving to agitate the rag stock as it passes through the apparatus. The stock is thrown into one end of the cylinder and as it moves along, the dust is drawn through the perforations in the wall by a powerful suction fan. In due course, the stock emerges from the other end of the cylinder, there to be deposited into bales and trucks. It should be understood that the axis of the "wimsey" cylinder is arranged in longitudinal fashion with the floor of the building.

Rag stock purchased in an unsorted condition is ready for separating into various grades upon the completion of carbonization and dust extraction. The stock is usually sorted for grade and color, the darker hued rags being placed by themselves for re-dyeing to black or some heavy shade. As the subject of rag stock sorting is a somewhat complicated one, and moreover, outside the scope of the present article, the matter will not be dealt with here. In a good many cases of dark colored stock, it is necessary to strip the existing color before re-dyeing to the wanted shade. Stripping with chrome and vitriol is a frequent procedure; this is done by treating the stock at the boil for a quarter to half an hour in a bath containing 3 to 5 per cent of bichrome, and 10 per cent of D.O.V. In cases where the color is insufficiently stripped by this treatment, the stock is entered into a fresh stripping bath containing a quantity of zinc-hydrosulfite-formaldehyde.

After this, the stock is re-dyed with chrome or acid milling colors, according to fastness, etc., requirements. Various preparations are on the market for use in stripping baths for protecting wool against the degrading action of strong acid and chrome liquor. The author has not known of many instances where the aforementioned preparations have been taken up by rag dyers, for the extra cost of these protectives often rules out their employment in such a cut-price business as the coloring of rag stock.

In certain instances, rag stock is stripped by treatment with boiling soda ash. This process is particularly applicable for use with rag stock consisting of remnants of ladies' dress materials, for this class of goods are frequently colored in their original state with leveling acid dyes which easily strip with alkali. A good deal of logwood black is used in re-dyeing woolen rags. When rag stock is to be re-dyed black logwood, a preliminary chroming of the material is usually necessary, for only a variable proportion of the stock may have been originally dyed with chrome colors. Chroming for logwood black is done with 2 per cent of bichrome for half an hour at the boil. If the rags have been carbonized, an addition of about one per cent of soda ash is made to the chrome bath in order partially to neutralize the residual acid in the stock. When this is done, shoddy which handles soft is obtained.

Afterchrome black is occasionally dyed on thin sorts of rag stock. For this, it is customary to make an addition of soda ash to the dyebath at the start in order to neutralize a portion of the acid in carbonized stock. Afterchrome black does not penetrate thick stock so well as does logwood black; hence, in instances where the former dyestuff has been employed, the shoddy is apt to show a thin gray black color in comparison with the rich full black obtainable by use of logwood.

There is also another fault which after chrome black dyed stock is prone to exhibit upon its conversion to shoddy, namely, that when examined overhand, the shade often discloses a reddish tinge which, in most instances, is very undesirable. This fault is due to unchromed fiber in the interior of thick stock through the failure of the bichrome to penetrate. In certain instances, woolen rags are stripped and re-dyed in a single bath with bichrome, vitriol and acid dyestuff. There are several acid colors which can be used for this process but the method is not much used for re-dyeing thick stock because of the extremely poor penetration of acid dyestuff applied in the combined stripping and re-dyeing bath. Such stock, when converted into shoddy, is found to possess a poor, thin color which on being examined overhand lacks solidity.

The following dyes are used in coloring rag stock. Chrome dyes: Chrome Yellows, generally; Alizarine Red S paste; Metachrome Brown; Afterchrome Black. Most blues are either too dull in shade or else too expensive for use with rag stock. Acid dyes: Milling Yellow and Orange; Milling Red; Patent Blue A type; Acid Blue Green of the milling class; Brilliant Milling Blue B or R; Rhodamine B; Brilliant Milling Violet of the 4B and 4R classes; Sulphoncyanine Navy and Black. Acid colors for use in combined stripping and dyeing process: Tartrazine; Acid Orange; Acid Red of the B type; Patent Blue A and Milling Green B types.

When applying the foregoing acid and chrome colors to carbonized or acid stripped stock, the unneutralized material contains sufficient acid to exhaust the bath unaided by further additions. In many cases it is well to partially neutralize the residual acid before re-dyeing the stock, in order to secure better penetration. This procedure

(Continued on page 578)

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October 8, 1934

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Proceedings of the American Association of Textile Chemists and Colorists

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the secretary any vacancies which may occur in their businesses.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

Kev: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive

Note. Persons who have obtained employment should notify the secretary at once. Prospective employers may file vacancies either with the secretary or the American Dyestuff Reporter.

A-2

Education—B.T.C., Lowell Textile Institute, 1932; also course in typing.

Experience—None to date, interested in quantitative analysis, experimental dyeing, color matching, dye testing and dye identification. Ability to learn quickly and will go anywhere. 23 years old, woman, single.

A-5

Education—B.T.C., Lowell Textile Institute.

Experience—Assistant chemist in carpet mill, dye tester in dye plant, research and analytical work in silk dyeing and finishing plant laboratory, plant chemist and overseer of bleaching in surgical dressing plant, assistant chemist in woolen mill. Age 29. Married.

A-6

Education—Analytical chemistry and dyeing course at Lowell Evening Textile School.

Experience—Three years as print chemist and one year as dye chemist for large print works. Two and one-half years as plant chemist for dyeing, bleaching, printing and finishing plant.

A-B-2

Education—Lowell Evening Textile School, 1917.

Experience—Five years' experience in hosiery dyeing, full fashioned hosiery of silk and cotton and silk, also men's hosiery containing rayon, wool, cotton and celanese. Several years experience in laboratory work. Has also had experience in jig-dyeing of cotton piece goods, slub and top dyeing.

A-B-C-1

Education—Graduate Industrial Chemical Engineer, Pratt Institute—1911.

Experience—One year as plant control chemist, 4 years as laboratory chemist with gas company, 13 years as plant chemist with bleaching, dyeing and finishing plant. (Rayon and cotton piece goods). Formulated processes and put them into plant operation, 1 year as chemist and demonstrator for dyestuff company, 1 year as superintendent colorist with print works printing linen and rayon, 1 year as director of testing laboratory for national dry goods concern.

A-B-C-2

Education—Graduate of Lewis Institute of Engineering of Chicago and graduate of Philadelphia Textile School (Chemistry and Dyeing department).

Experience—Has had extensive experience as assistant chemist and colorist in silk printing, dyeing and finishing; also dyeing raw stock wool; and dyeing and finishing cotton and rayon. Age 30; married; references.

A-E-2

Education—B.T.C., Lowell Textile Institute, 1933.

Experience—Assistant instructor in chemistry, Lowell Textile Institute. Member of scholastic honorary fraternity.

A-E-1

Education—Ph.D., Univ. of Illinois, studied chemical engineering at Columbia, licensed chemical engineer, New Jersey.

Experience—10 years' experience teaching in colleges, subjects included chemical and textile subjects. Has had broad experience in industrial work including experience in testing materials, research and consulting. Will go anywhere; references.

B-1

Education—Educated and trained in chemistry and calico printing in Glasgow, Scotland.

Experience—Has been with large print works as colorist for 13 years producing first class work on cotton, rayon, wool and silk fabrics. References.

B-2

Experience—Boss dyer with one firm for 18 years, divisional supt. at print works for 1 year, in charge of processing and dyeing of cottons and rayons at large bleachery for 6 years. Prefers bleachery in East but will go anywhere. References.

B-3

Experience—Foreman piece dyer for the past 21 years. Can dye the following; celanese, rayon, cotton lacks, wool, silk and mixed fabrics. Has knowledge of finishing and laboratory work.

B-6

Education—Graduate R. I. School of Design.

Experience—5 years in bleachery, 7½ years as assistant dyer, 2 years as boss dyer and 3 years as superintendent of dyeing and finishing. Married, 33 years old. References.

B-7

Experience—Eight years as boss dyer on skeins and ribbons. Over ten years as chemist and head dyer for a large hosiery mill. Experienced on Silk, cotton, rayon and wool in skeins, ribbons, piece goods and all kinds of mixtures. Willing to go anywhere. Not afraid to work or face responsibility. Can handle help efficiently.

B-8

Education—Chemistry and Dyeing Department, Philadelphia Textile School.

Experience—Eleven years experience as chemist and

boss dyer on the following: woolen, worsted and cotton yarn; woolen, worsted and union piece dyes on both ladies' and men's wear; wool, cotton, shoddy and mohair raw stock. Age 33, married, will go anywhere. References.

B-9

Experience—Hosiery dyer with fifteen years' experience on high grade silk hosiery; familiar with all types of machines. Age 43, married. Will go anywhere.

B-12

Education—2 years days at N. Y. U. and 3 years nights studying chemical engineering.

Experience—1½ years asst. colorist, 5½ years colorist. Experienced on vats, commercial and fast colors on cotton and cotton-rayon mixtures. References; age 29; married.

B-13

Experience—Large experience as an assistant colorist chemist in silk printing, dyeing and finishing; also on cotton and wool dyeing. References.

B-14

Education—Rhode Island School of Design.

Experience—Familiar with all classes of wool dyeing. Seven years with large carpet mill as dyer and processor of washed oriental rugs. Will go anywhere, married, 37 years old. References.

B-15

Education—B.T.C., Lowell Textile Institute, 1934.

Experience—Experience in dye house running washers, dye kettles and as a dye weighter.

F-1

Education—Textile Institute, Alexander Hamilton Inst., Extension work at Brown Univ., working knowledge of German.

Experience—Has had executive departmental work with all types of textiles manufacturers. Acquainted with all types of textile machinery, dyestuff application, laboratory practice, cost methods, and checking methods and processes. References.

REPORT OF THE NOMINATING COMMITTEE

THE voting members of the Nominating Committee, A. T. Brainerd, M.W.; C. Z. Draves, N.N.E.; C. L. Eddy, Pied.; R. H. Harris, S.E.; H. F. Lawton, R.I.; T. J. Marler, S. Centr.; C. A. Seibert, Phil.; and P. J. Wood, N.Y., report unanimous agreement on the following nominations:

President, Robert E. Rose.

Vice-President, Arthur R. Thompson, Jr.

Vice-President, William H. Cady.

Treasurer, William R. Moorhouse.

Secretary, Harold C. Chapin.

Councilor-at-Large, Carl Z. Draves.

Councilor-at-Large, Henry F. Herrmann.

The Constitution of the Association, in Section VIII, states, "Counter nominations for any office, signed by at least ten members, may be filed with the Secretary not later than November 1."

Respectfully submitted,

H. C. CHAPIN,
Secretary

CALENDAR OF COMING EVENTS

Meeting, New York Section, Chemists Club, New York, N. Y., October 26.

Meeting, Philadelphia Section, Penn Athletic Club, October 26.

Annual Meeting and Convention, New York, N. Y., December 7 and 8.

Annual Convention and Meeting

—•—

New York City

—•—

December 7th and 8th

—•—

Start Planning Now

—•—

Headquarters — New Yorker Hotel

AMERICAN
DYESTUFF
REPORTER

LOUIS A. OLNEY, Sc.D.
Professor of Chemistry and Dyeing, Lowell Textile Institute
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Published biweekly by
HOWES PUBLISHING CO., INC.
440 Fourth Avenue, New York City

A. P. HOWES
President

M. D. REESER
Secretary

H. F. CRAWFORD
Treasurer

Subscription price: $5.00 per year; Canadian $5.80 foreign $6.00

Vol. XXIII October 8, 1934 No. 21

DISCRIMINATION?

IT IS generally conceded that labor has the right to work or not—in fact, we all reserve this privilege. If we take advantage of the privilege of not working when our labors are desired and when we have no other means of support we should also be willing to acknowledge the privilege of the employer to hire those persons who are willing to work and we should be willing to subsist as best we can. When we decide that we are willing to return to our labors we should not feel offended if someone has taken our place or if there is no longer need for our services. If we should decide to strike when our services are not especially in demand (in fact, the employer may just be "carrying" us along) it would appear to us as if the employer was more than justified in choosing only those in whom he felt qualities were apparent that would make such persons more desirable as employes. Futhermore, if we should take the opportunity of preventing others from working while we were exercising our privilege of striking or if we should incite damaging riots or other forms of violence we should be very much surprised indeed if the employer should choose us to labor for him when we decided we were willing to return. However, if we forced all those who wished to work to stop, thus closing the employer's mill and the employer then agreed to take back without "discrimination" as many employes as he could use we could hardly hold it against him if among the employes he chose to re-employ there were a majority of those who had been willing to work but who were forced to cease their labors because of strikers' "influence." Even though it may be our privilege to cease our labors it is also the privilege of others to continue working. In the same manner it is also the employer's privilege to choose those employes who, he feels, will be the more satisfactory.

Evidently the above views do not coincide with the views of the instigators of the textile strike which was recently started, lasted a few weeks and then ended. At the conclusion of this strike employers were asked to take back the workers, active strikers and "drafted" strikers alike, without *discrimination*. To the credit of the employers, they apparently have been doing this as rapidly as conditions have become favorable to employ more hands. Union officials, however, have made charges of "rank" discrimination and have advised many of the strikers who were not re-employed immediately to file with the new Textile Labor Relations Board prepared forms for this purpose. While speaking of discrimination it is peculiar that the union officials responsible for the strike have not considered that it would also be discriminating to employ active strikers in preference to those who remained at work in spite of pressure brought to bear upon them.

If the employers are discriminating against strikers now it is certainly no more unjust than the discrimination showed by the workers when they left their jobs. Regardless of whether the laborers should or should not have gone out on strike or whether their demands were fair or unfair they should not complain if persons who showed less tendency to join the strike and more inclination to work are now favored by the employers. Just as a strike is the undeniable tool of the laborer to secure his demands so is a boycott the employers' strongest weapon in combating his demands. Although we would all rather see the use of amicable arbitration and mediation in place of such tools, those who do use these implements should not complain of the results attending their use.

It is unfortunate that disputes between capital and labor cannot be settled by peaceful methods. A strike generally accomplishes but little and frequently adds to the hardship of all concerned. There seems to be no such thing as permanent victory for either faction, for the settling of one dispute quiets the scene for only a relatively short space of time. A real truce between capital and labor in the textile industry would be very desirable. If the industry could be certain of no more labor troubles both parties would be eased of a great deal of uncertainty.

The settlement of the general textile strike brought forth a statement from the strike leaders that they had scored an overwhelming victory. The cries of discrimination would indicate that it had been a very hollow victory indeed.

● COMMUNICATION

The Editor,
The American Dyestuff Reporter,
Dear Sir:

In your July 30th 1934 issue reporting the discussion on Mr. Murphy's paper the Lecturer was asked for a method of distinguishing between a pattern dyed with a direct cotton color and one which has been diazotized and developed. It may be of interest to say that the writer has used the following method for many years, and while not claiming that it is infallible it will be found extremely useful.

The method is to wet the pattern to be examined, and also to wet a known developed pattern and a known direct pattern of approximately the same depth of shade as the pattern being tested. If these are then put inside white calico and dried simultaneously on a hot steam pipe it will usually be found that the direct cotton color will stain the white calico and the developed color will not.

As I said the test is not absolutely infallible, but with a little practice anyone will be enabled to distinguish the majority of deveoped dyes from direct dyes.

Yours faithfully,
C. M. WHITTAKER.

● S. O. C. M. A. MEETING

The luncheon and general meeting of the Synthetic Organic Chemical Manufacturers Association was held at the Chemists' Club, New York City on Thursday, September 20th with President Merz presiding.

The subjects discussed included N. R. A. codes, reciprocal tariffs and import bulletin No. 2865 dealing with coal tars.

The meeting adjourned at 2:30 and the next meeting will be October 18th.

● EXPANSION CONTINUES

The expansion of Japan's domestic chemical industry is strikingly reflected in its foreign trade in chemicals and allied products during the first half of 1934, according to C. C. Concannon, Chief of the Commerce Department's Chemical Division.

Japanese exports of such products were valued at 41,131,000 yen ($13,700,000) during the first six months of 1934, an increase of 44 per cent over the corresponding period of the preceding year, and 130 per cent over the first half of 1932. Almost all principal items of export contributed to the increase, particularly drugs and explosives, coal tar dyes, fertilizers, especially fish meals, celluloid, peppermint oil, paint products, and certain toilet requisites. Isinglass and linseed oil declined slightly and artificial fertilizers remained the same, compared with the first half of 1933. Mr. Concannon pointed out that low yen exchange has assisted materially in facilitating shipments to many of Japan's markets.

Imports of chemicals and allied products into Japan during the first half of the year were valued at 104,835,000 yen ($35,000,000), an increase of 5 per cent compared with the corresponding period of 1933, and 16 per cent as compared with the first six months of 1932. Marked declines occurred in receipts of rosin, glue, gelatin, boric acid, tartaric acid, glycerine, dyes, paints and soda.

A total of 189,870,000 yen ($42,644,800) was invested in Japan's chemical industry during 1933, thirty-three new companies accounting for 102,920,000 yen and the remainder being used to expand existing plants, according to figures published by the Bank of Japan. Generally the new companies were formed to manufacture items which Japan has heretofore imported from foreign countries, Mr. Concannon stated.

● REMOVAL

The sales and the purchasing departments of the Glyco Products Co., Inc., will be located in the Flat Iron Building, N. Y. C. beginning October 1, 1934.

The laboratory and plant will remain in Bush Terminal, Brooklyn, N. Y.

● FILTRATION

"Filtration and filters for industrial use" is the title of an interesting booklet just issued by the Filtration Equipment Corporation, 350 Madison Avenue, New York. Among the several types covered are "Rotary Vacuum Filters and Rotary Vacuum Dewaterers, Open Tank Leaf Filters and Magnetite Sand Filters used in the production of chemicals. The Filtration Equipment Corporation is well known for its work in the field of sewage treatment and disposal. That it also specializes in industrial filtration will be news to many. This booklet will be mailed free on request to anyone interested in the subject of filtration.

● BULLETIN

A bulletin has been issued by the Lukens Steel Co. of Coatesville, Pa., entitled "Lukens Nickel Clad Steel in the Textile Industry." Applications of this metal are illustrated. Copies of the bulletin are obtainable on request.

Rosins, Viscose, etc. in

Finishing Cotton Cloths*

The Properties of Rosin and Some Examples of the Formation of Synthetic Resins in the Fabric

By J. A. CLARK

ROSIN is a brittle, easily friable solid obtained as a residue after the distillation of crude turpentine. The resin is collected in boxes cut into the base of the tree, from which it is removed and distilled in copper stills heated by direct flames. After removal of the volatile spirits of turpentine, the rosin or colophony is drawn off, strained, and poured into barrels to solidify. The rosin is graded according to color, the lighter colors, commanding higher prices, are obtained from the first year dip. The older workings yield darker rosins. This material is graded as follows:

WW	Water White	F	Good No. 2
WG	Window Glass	E	No. 2
N	Extra Pale	D	Good Strain
M	Pale	C	Strain
K	Low Pale	B	Common Strain
I	Good No. 1	A	Black
H	No. 1		

Rosin varies in color from pale amber to dark reddish brown or black, has a specific gravity only slightly heavier than that of water and while softening at 70-80° C. may only become fluid at temperatures of approximately 130° C. Overheating causes the product to darken in color. Insoluble in water, rosin is quite soluble in many organic solvents, oils and alkalies. It is an oxygenated hydrocarbon containing a high percentage of the anhydride of abietic acid and variable amounts of unsaponifiables, the latter increasing in amount with the darker grades.

Salts of the heavy metals react with soluble alkaline solutions of rosin to precipitate insoluble compounds, while acids separate the insoluble abietic acid. Caustic or other alkalies, as well as ammonia, react with rosin to form the corresponding salts or "soaps." These are soft and sticky and of a dark brown color, dependent on the quality of the rosin used. These soaps are also hygroscopic, soluble, and have free lathering properties.

Rosin is widely used by varnish makers and by soap makers, since a good grease will carry 25 to 50% of rosin without being too soft or sticky in the soap, and combinations with alum by paper makers as a sizing. It is used extensively as a flux for solder and other low melting alloys. Sealing wax also contains a high percentage of rosin, and fly papers may be made by melting rosin in oil and applying to paper.

Textile Uses

The use of rosin in the finishing of cotton is confined generally to its use in kier boiling and as an ingredient of backfilling mixes where it serves as a binder for the mineral fillers to prevent dusting. Rosin was formerly added to the caustic or soda-ash boil following a lime boil. When used in the usual caustic boil, it is more commonly used in conjunction with soap or soluble oils.

Some of the commercial kier boiling soaps recently offered, on analysis prove to be mixtures of red oil and rosin soaps with some pine oil. The older kier boiling soaps were widely used, although their rosin content was open to suspicion because of the difficulty in obtaining its complete removal by rinsing. This, of course, introduces the danger of after-yellowing in white goods or resists with goods intended for dyeing. One bleachcroft which made its own kier soap used the following formula for a long time:

Red Oil	2050 lb.
Rosin	1050 lb.
Soda Ash	290 lb.
Caustic 50° Be.	746 lb.
Water to make	11000 lb.

* Reprinted from The Textile Manufacturer.

Rosin size is used as a binder for heavy backfill mixes, especially in those mixes in which the proportion of mineral fillers to starch is exceptionally high. Its adhesive and sticky nature is very effective in anchoring these to prevent dusting. This product is prepared by the saponification of powdered rosin with ammonia or soda ash and is so proportioned as to contain approximately 25% of the rosin uncombined and with 25 to 50% of water. This forms a thick, viscous, sticky product of characteristic rosin odor which can be incorporated in the mix. In large amounts, however, it imparts a harsh feel to the cloth and may cause slight yellowing of the fabric on storage or heating. Its use may, however, be entirely satisfactory for colored heavily backfilled goods, where the slight harshness might not be a serious handicap, or could be compensated for by the addition of sufficient softener.

Synthetic Resins

Following Dr. Bakeland's publication of the research and procedure for the manufacture of Bakelite by the reaction of formaldehyde on phenolic compounds in the presence of catalysts, various other investigators sought to apply this and a wide variety of similar reactions to fabrics. The reactions between aldehydes and various organic substances, especially those containing hydroxyl groups, such as phenol, glycerine, urea, phthalic anhydride, etc., yield a wide range of synthetic resins, with widely different physical properties. Various methods of application have been tried. For instance, the fabric may be treated with a solution of the ingredients, which by subsequent drying and ageing are condensed to the resin, or resin may be formed in solution as a half-way product which can be applied and subsequently condensed on the fabric by drying and heating for a short time. One patent acquired by an English concern described the process of impregnating a rayon fabric lightly with phenol which was followed by exposure to formaldehyde vapors at elevated temperatures. The object of this treatment was to render the rayon resistant to the action of water.

Bead Fabrics

One very beautiful but highly impractical application of this type of resin was the formation of brilliant spots on cloth to form the so-called Jewel print. A hanging drop was formed on the cloth by a very ingenious device of drawing a wire dipped in the resin through the fabric, which was held horizontal under tension as in a tenter frame. The resin was wiped off the wire passing through the cloth which formed conical shaped drops, the largest fo these being fully 3/8-in. long. Following the heat treatment, these appeared as high, lustrous and sparkling spots, but unfortunately women did not possess sufficient fortitude to wear the cloth, while it was also detrimental to furniture. Its rather high cost was, moreover, a handicap to its general adoption.

Treated Fabrics

One fabric recently introduced commercially contains a flexible resin applied as a facefilling of the ingredients, which are subsequently condensed by heating to yield the condensed resin. This cloth is entirely different in appearance from the usual coated fabric, is very flexible with good drape, and offers possibilities for keen competition, especially in the raincoat field. The latest application of the synthetic resins to receive popular notice is in the grease-proofing of fabrics. Tootal, Broadhurst, Lee Co. Ltd. hold patents for this process, which are being put into commercial operation in this country by at least two licensees. This process consists of forming the synthetic resin within the fibers. (Perhaps, rather, round the fibers.—Ed., T.M.). This imparts a resiliency to the fabric such that if crushed in the hand it springs back when released. While not exactly creaseless, this process is said to create resistance to creasing as well as recovery from creasing to such an extent that garments of such fabrics, crushed either by wear or in travelling bags, become presentable after hanging a short time. This treatment increases the weight approximately 15%, is reasonably fast to laundering, increases the breaking strength of rayons, of the regenerated cellulose type, when wet, and helps to prevent slippage of warp or filling yarns in light fabrics. It can, so far, be applied to cotton and the various rayons, with the exception of the Celanese types. Its successful application to linen is as yet not worked out, although notices to this effect are now appearing in the technical journals.

The following is reported to be an example of this this process, although other methods are also covered in the patents.

The fabric is padded with a liquid composed of: 20 parts formalin 40%, 10 parts urea, 5 parts boric acid, and 60 parts water at room temperature and dried at 130° C. The cloth is then heated at this temperature for 30 minutes longer, after which it is thoroughly soaped at the boil to remove the resin adhering to the outside of the fabric.

Viscose Coating, Etc.

The metallic luster of rayon has long suggested the possibility of treating cloth with viscose or other rayon forming solution to obtain a highly decorative lustrous fabric effect. This has been the subject of numerous patents although their application has been commercially negligible as yet.

Viscose, briefly, is made by the reaction of carbon bisulfide on alkali cellulose to form sodium xanthate, which is then decomposed to regenerate cellulose. This regeneration may take place in several ways. In the first place, solutions of viscose undergo a type of polymerization spontaneously until in a few days at ordinary temperatures, it breaks down, liberating the hydrocellulose.

(Continued on page 578)

Technical Notes From Foreign Sources

Fast Dyeings on Vegetable Fibers (Naphthol AS Series)

German Patent No. 467,545 (25/X/'28)—*I. G. Farben-Ind. A. G.*—German Patent No. 256,999 and several others have pointed out that by coupling unsulfonated diazo-salts to members of the Naphthol AS series, dyeings on cotton valuable in various ways are obtained. The present, more precise patent specifies the use, as a first component, such amino-compounds as are substituted in the 2-5-position, to the amino-group, of which substituents at least one must be a chlorine atom. It is claimed that such dyeings are of clear tone, and good fastness, particularly to kier-boiling. One example—citing the use of 4-chlor-1-2-toluidine or "chlor-2-aminodiphenyl ether." In each case, the dyeings are clear reds of excellent fastness to kier-boiling (the second component is 2-hydroxy-3-naphthoic beta-naphthalide).

The present patent employs, as the basis of the reserve, an artificial resin, insoluble in alkalies, such as is described in French Patent No. 612,306. Such resins are printed in the melted state upon the cloth, and when the reserve is cold the cloth is grounded as usual (six examples), the resin being finally removed by melting, or washing with suitable acids or organic solvents.

Utilization of Dilute Waste Alkali Liquors

G. Rordorf—Monats. f. Textil-Ind. 48, 106 (1933).—The waste alkali-liquors in a dilute form, as they are met with, say, in the mercerization of cotton, are a source of loss unless utilized in some way. The author suggests the possibility of converting them to hypochlorite by passing in chlorine gas, so readily and cheaply available nowadays in the liquid form, in cylinders, and so being able to cut the cost of purchased hypochlorite in the plant, or, if the plant prepares its own hypochlorite already, to cut at least the cost of the caustic bought for the purpose; or the sale of such liquors to other plants which use caustic solutions of such concentrations (the author does not refer to mere very weak, dilute "washings," but to the stronger liquors such as would result from the first washing of mercerized goods). Other possibilities are also spoken of.

Study of the Solutions of Substantive Colors

M. Lesbre—TIBA 10, 9 (1932).—The first and only introductory part of a thesis presented for the doctorate of the University of Lyons.

Aniline Black on Animal Fibers

"R."—TIBA 12, 255 (1934).—The continuation and final section of the paper.

The present part deals in detail with the dyeing of half-wool, silk, and leather.

Studies in Degumming of Silk

Dr. J. Stockhausen—Seide 37, 387 (1932).—An experimental paper, with five tables of numerical findings.

The conclusions reached by the author are as follows:—

a) The view that the process of degumming of silk depends upon an alkaline degradation of the sericin, through the alkali set free from the soap by hydrolysis, has been confirmed again. This fact, therefore, requires the maintenance of a certain percentage of the soap in reference to the weight of the silk under treatment.

b) Synthetic scouring agents, which do not hydrolyze in the bath, are not to be recommended.

c) By diminishing the amount of soap in the bath, and replacing the deducted portion by synthetic scouring-materials, the lack of the necessary soap is not made up, and the action of the soap present is influenced unfavorably. The use of such agents is not advised on any ground.

d) The harmful action, upon the process, of such synthetic assistants in the presence of soap, seems to be, that they depress, to a certain extent, the necessary hydrolysis of the soap also present.

e) Soaps containing fat-solvents also appear to be unsuitable for degumming silk, in comparison with plain soap of a suitable grade. It is hard to see what purpose the fat-solvent in the soap should fulfill; it is also to be questioned whether the fat-solvent, in the subsequent use of the bast-soap, may not exert a disturbing influence; and whether the lower fat-content (compared to that of a normal textile soap) may not render the bast-soap less rich in fatty material than is desirable.

In other words, the old-fashioned method of degumming silk is still the best.

Influence of Cold Weather, etc., upon the Working-Up of Artificial Silk

A. Kindermann—Monats. f. Seide u. Kunst-Seide 38, 32 (1933).—Artificial silk has for a good while been known to be very sensitive toward moisture—its tensile strength, elasticity, and flexibility all vary very greatly according to the amount of moisture contained in the fiber. Reference is not here made to actually moist or wet fiber (though the fact that viscose, for example, in a really wet state has only about 40-50% the tensile strength of the dry fiber), but such moisture as is normally present in a "dry" fiber, by its taking up moisture from the air. The breaking-strength, e. g., is generally reckoned on a fiber which has taken up as much moisture as it will in an atmosphere of about 65% relative humidity. About 100 parts by weight of bone dry viscose will take up about 11 parts by weight of water from the air. This

amount of course varies steadily with any variation in the relative humidity of the atmosphere to which the fiber is being exposed. The fact that the relative humidity varies from day to day, even from hour to hour, in the factory, during what might be called ordinary weather according to season, has apparently received too little consideration; but the unusual dryness of the air during periods of abnormal cold during the winter season seems not to have been considered at all, even though outside the relative humidity is actually at zero, and very, very low within doors. Yet the sinking of the relative humidity means simply this; that the fiber dries out, and that its loss of tensile strength, elasticity, and flexibility mean a much higher degree of breakage of filament during the mechanical working up, and that time and money are therefore lost.

It is perfectly true, that, by drying out, a fiber becomes more "solid"; but this solidity means a certain loss of the properties which permit it to be worked up successfully. Attention should be paid to control of humidity within the workrooms under all conditions of weather and season.

Cross-Sectioning of Serial Filaments in Weaves

Dr. W. Coordt—Monats. f. Seide u. Kunst-Seide—38, 69 (1933.—The method here described has only to do with the preparation of the block for sectioning (imbedding in paraffine, sectioning in the microtome, and subsequently as usual, is the method followed). The device described is one for getting the filaments well located in the paraffine block, instead of at haphazard; a shallow box of sheet brass, of dimensions suitable for the size of paraffine block desired, is prepared, out of which rectangular depressions are out in the edge of two opposite sides. The material, after any due preparation, is laid across the box, in these two depressions, and then turned under and fastened to the bottom of the box (outside) with rubber cement, adhesive tape, etc. so that the fibers lie side by side, under tension, about midway down across the box. When the box has been filled with melted paraffine, a brass lid, U-shaped, is slid across the top of the box as a cover while the paraffine is cooling very slowly and setting.—One illustration is added.

Treatment of Dyeings on Acetate Silk (Improvement of Fastness)

German Patent No. 465,345 (14/IX/'28) — *I. G. Farben-Ind. A. G.*—There is a considerable number of dyestuffs, soluble in water as alkali salts, which dye acetate silk well, but which, owing to their slight affinity for the fiber, are not at all fast to washing, and bleed into adjoining fibers in mixed weaves, for example. The present patent avoids this difficulty by adding to the bath certain substances, organic salts, which are soluble in water or organic solvents; and in particular the salts of aryl-biguanides. In example 1, the compound employed is the hydrochloride of phenyl-biguanide (2.5 g., and 4.0 g. of common salt, in an 800 cc. bath containing the dyestuff as well). In the other example, 2-naphthyl-biguanide is similarly used. The biguanides are easily prepared by boiling together, in aqueous solution, the now common dicyan-diamide, and the hydrochloride of the base whose hydrocarbon radical is desired (aniline, 2-naphthylamine, in the two present examples).

Disazo Dyestuffs

German Patent No. 469,341 (17/XII/'28) — *I. G. Farben-Ind. A. G.*—German Patent No. 409,202 describes disazo dyestuffs formed by coupling to various second components the tetrazotized derivatives of 4-4'-diamino-diphenyl-urea-3-3'-dicarbonic acid, are by forming the ureas of similar couplings from 2-5 diaminobenzoic acid. The present patent extends this idea to include the ureas or thio-ureas of the amino-aroyl-2-5-diaminobenzoic acids, as first components. The products have greater affinity for cotton, and on aftertreatment with appropriate metallic salts become faster to washing. The colortone tends to pass from yellow toward red by such treatment.

Seven examples are given, covering yellow, yellow-brown, bordeaux, red-violet, and clear violet, all through after-coppering.

Fast Dyeings, Method for Producing

German Patent No. 464,083 (7/VIII/'28) (*addition to G. P. No.* 393,701 *of* 17/II/'22)—*Gesells. f. Chem. Ind. in Basel*—The method of developing originally described involved the use of 4-hydroxy-l-aryl ketones as the second component in azo couplings. The present patent retains this component in particular, but specifies as the first component tetrazo compounds of the general formula HO—N=N—R_1——N=N—R_2——N=N—OH, R_1 and R_2 being aromatic nuclei one of which at least is a cresidine nucleus. With such components, violet to blue tones of great fastness are obtained.—Two examples are given.

Dyeings of Cellulose Esters and Ethers

German Patent No. 477,507 (8/*VI*/'29)—*I. G. Farben-Ind. A. G.*—Primary disazo dyestuffs are here considered, of any two desired diazo-salts (first components) within certain limits (see below), each coupled to a mono- or dihydroxy-derivative of the benzene or naphthalene series, of such nature that it can be coupled to in each of two positions. Of the total constitution of the products, not more than one naphthalene ring, and not more than one sulfonic group if any, may be present, and at least one free amino-group must be present. Dyeings from such products are of strong tone. Four examples are given. One of the dyestuffs proposed is prepared by coupling diazotized sulfanilic acid to phenol in the para position, then to this mono-azo dyestuff is coupled diazotized para-nitraniline, which enters in the ortho position in the phenol ring (the product is therefore one of the valuable o-hydroxy-azo dyestuffs), followed by reduction of the

nitro to the amino group by cautious treatment with sodium sulfide. The color yielded by this product is a strong golden yellow.

Dyeing of Acetate Silks

German Patent No. 473,454 (10/*III*/'29)—*I. G. Farben-Ind. A. G.*—The process here described consists in dyeing the amino-anthraquinones (in the broader sense) upon acetate silk, by dissolving these in concentrated sulfuric acid, and pouring into water, filtering, and washing to neutrality (which should give the amino compound again in the free state, in a finely divided condition—the sulfates are usually completely hydrolyzed by enough water). The paste is then stirred up into a bath with water and about 5% of the neutral reaction-product of sulfur and phenol (described in German Patent No. 348,530), and the goods dyed at a bath-ratio of about 1/20, at 60°-70° C. The dyeings are claimed to be quite fast to rubbing, washing, and light, a-amino-anthraquinone gives bright orange tones, 1-4-diamino-anthraquinone gives bright violet tones, 1-4-5-8-tetra-amino-anthraquinone fast blue, and a-methyl-amino-anthraquinone bright red dyeings.

What takes place chemically in such a bath is not easy to figure out.

Mono-Azo Dyestuffs

German Patent No. 475,685 (29/IV/'29)—*I. G. Farben-Ind. A. G.*—The principal feature of this patent seems to be the employment of p-hydroxy-phenyl-2-naphthylamine or its derivatives. With it are combined, by coupling, the diazo-salts of 4-nitro-aniline-2-sulfonic acid or its derivatives, of 5-nitro-2-amino-benzyl-omega-sulfonic acid, or the sulfonic acids of 4-nitro-1-naphthylamine. Although such couplings possess a free para-hydroxyl, they are very stable, and dye wool in violet to black tones. Those dyestuffs which possess only one sulfonic group, and that in the first component, are also good dyestuffs for acetate silk, of course.

It is suggested that, as the second component, the use of p-hydroxyphenyl-2-naphthylamine-3-carbonic acid will give good results, but this is of course covered by the claim "or its derivatives".—Three examples and one table are given.

Azo Dyestuffs, Basic

German Patent No. 473,526 (22/*III*/'29)—*J. R. Geigy A. G. in Basel.*—The present patent covers, in general, the introduction of aliphatic basic groups or the like into azo dyestuffs. For this purpose, the dyestuff chosen for conversion must contain one or more primary or secondary amino groups, and no sulfonic acid groups. By reaction with chloracetyl chloride, the chloracetyl radical is substituted into the above-mentioned amino groups, and the halogen of the newly introduced chloracetyl group then reacted with primary or secondary amines of the aliphatic or aromatic series, the halogen being replaced by the basic residue of the last amine used. (It is very difficult to see how any tertiary base (though these are mentioned) can enter into a genuine synthetic reaction of this nature, other than serving as a mild and non-complicating neutralizing agent, in the reaction of the acidyl and alkyl halogen with the amino groups reacting). Some of the points involved are difficult to understand.—Instead of such a process as the above, the sequence may, of course, be inverted, and such compounds as already contain the desired basic groupings be used as coupling components. The products are of course strongly basic azo dyestuffs, mono- or primary or secondary disazo products, in the form of their salts; they behave in dyeing like ordinary basic colors.

Eight examples and one table are given.

Deterioration of Hypochlorite Solutions

A. Kling and R. Schutz—Compt. Rend. Ac. Sciences (1931) *p.* 1655.—Of the two reactions which hypochlorites may undergo in decomposition, under the influence of light, heat, and storage, i. e. passing to chloride with evolution of oxygen, or passing to a mixture of chlorate and chloride, the latter decomposition takes place only in solutions under 12° B. An analytical method is given.

Study of Solutions of Substantive Dyestuffs

M. Lesbre—TIBA 10, 293 (1932).—The first part of this paper (a thesis) has been previously noted. A good deal of discussion of the views of previous workers, as to relations between absorption-spectra, degree of dilution, the colloid condition, etc., is involved. The close of this section of the paper takes up, too briefly for the interest which we feel, the question of the use of the photo-electric cell in unravelling some of the relations which are at present so obscure. The whole paper is one which will have to be studied by anyone who is looking seriously into the problem of the cause of color in dyestuffs, in a fundamental way.

Ultra-Violet Radiation in the Textile Industry

G. Desmurs—TIBA 10, 307 (1932).—A preious part of this paper appeared in an earlier issue of *TIBA* (see the March, 1932 number). The present section is interesting; it covers the fluorescence-phenomena of a large group of tannins, with other information beside the fluorescence colors (four tables), and of synthetic dyestuffs, this group naturally, in view of its enormous range, being discussed in very general terms. The tables referring to the tannins would be of great value for reference, to anyone interested in that group.

Printing upon Woollen Weaves with Vat Dyestuffs

"Y."—TIBA 10, 321 (1932).—A discussion of an I. G. patent (French Patent No. 708,141).

The danger involved in the use of alkalies in working with wool under any conditions, and that of the use of hydrosulfite in the heat (from steaming, e. g.), is avoided by the present process, at least, as far as dyestuffs which can be vatted easily are involved. The oxidation can in such cases be effected by contact with air, which avoids the use of oxidizing agents dangerous to animal fibers, and allows the regeneration of the dyestuff in the fiber to take place more gradually—which of course means a better penetration of the fiber. Principally, the details of the process consists (a) in using dyestuffs easily reduced, (b) in using the barest minimum of hydrosulfite and of alkali, (c) in adding glucose or substances of similar nature, which will act both as a protective colloid, and also help in the reduction of the dyestuff in the presence of the alkali. The general operations are as usual, and, with the goods thus padded, the usual steaming and development in an oxidizing bath can be carried out if desired.—Hydrosulfite instead of Rongalite permits steaming at a lower temperature and for a shorter period (though Rongalite is included in one of the three examples).

One example may be given in detail; (the dyestuff is one not named by title, obtained by condensation of 5-m-chlorphenylamino-3-methyl-2-1-aminothiophenol with chloranil).

Dyestuff as 16% paste	100 g.
Glycerol or ethylene glycol	80 g.
British gum paste, 1/1	500 g.
Triethanol amine	0-30 g.
Sodium phosphate	0-30 g.
Glucose	50-100 g.

This paste is warmed to about 70° C., and a mixture of hydrosulfite conc., 10-25 g., ammonia water 20-40 cc., and water, 230-295 cc., is stirred in. This paste is then best allowed to stand for some hours before use. After printing, the goods (wool or weighted or unweighted silk) are dried, steamed for six minutes in absence of air, with rather moist steam, rinsed, and developed for a few minutes at 30°-50° C. in a bath containing, per liter, 5-10 cc. of hydrogen peroxide of 30% by volume, and 2 cc. of 10% ammonia water, or 5 cc. of hydrogen peroxide of 30% by volume and 5 cc. of acetic acid of 30%, then rinsed. Final treatment may be with sodium perborate or some similar agent, or by soaping at 60°-70° C., with or without perborate. The results are excellent.—Another formula substitutes borax for sodium phosphate, and includes some Rongalite to replace part of the hydrosulfite.

Immunized Cotton

Q. 483—*TIBA* 10, 345 (1932).—In reply to a query in the correspondence column, a very good discussion of the above subject is printed—no definite details, but a general description of the methods used. It would seem that p-toluene-sulfonchloride is the acid chloride principally employed, doubtless because of its fairly low price as a by-product from the manufacture of saccharine and perhaps also because it is a solid at ordinary temperatures, of the usual disagreeable odor, though not strongly pronounced. Benzoyl chloride is also mentioned; it should esterify the cotton more promptly, perhaps, than the sulfonic chlorides, but is a chemical that usually has to be prepared deliberately if needed; it is seldom if ever a by-product from other processes, and might prove more expensive; beside, it is a liquid, and its odor is not so much disagreeable as exceedingly irritating to the eyes, nose, and throat. The cotton, in whatever condition, has to be treated first with a caustic alkali, or in some processes soap or certain penetrating agents have to be used also; in inert solvents usually, such as gasoline, ether, or tetrachloride. The product, in comparison with cotton, is whiter, more voluminous, less transparent, hygroscopic, wetting out with more difficult than untreated cotton, possessing a rougher feel, and is more resistant to hypochlorite, caustic liquor, and strong acids. Its tensile strength differs little from that of cotton, since only the surface of the fiber is altered. It has no affinity for sulfur or vat colors, or in fact for any group of dyestuffs except the basic colors. There are several patents which have been issued covering the matter; German Patents Nos. 438,883 (the original one, of Cassella), 451,614—396,926—445,221—438,324—English Patents Nos. 224,502—195,619—236,588—223,704—246,609—245,759—249,842—284,358—French Patents Nos. 563,735—604,433—and Canadian Patent No. 258,637.

Algae and their Uses

Dr. A. Beyer—TIBA 10, 325 (1932).—The second part of a long paper, the first section of which we regret not to have been. A very interesting paper indeed, taking up the subject from the purely chemical side, but with a strong glance toward the technical side, and full to repletion of information. We had had no idea that so much was known of the alginates and related compounds.

Hydrogen Peroxide in Bleaching of Textile Materials

E. Billot-Monet—TIBA 10, 405 (1932).—The first part of a descriptive discussion, so to speak, of the use of peroxide in bleaching. Thus far the paper is of a general sort.

Ultra-Violet Radiation in Textile Work

G. Desmurs—TIBA 10, 417 (1932).—A continuation of a paper, a previous part of which has already been noted in these columns. The present section covers the topics of the resistance of artificial colors to light, the differentiation of textile materials by Wood's lamp and by chemical tests together, and the differentiation of artificial textile materials by the mercury vapor arc-lamp, with chemical tests also. The paper is to be continued. This is an interesting section.

OILS AND STAINS

(Continued from page 562)

The effects produced are (1) finely-divided lead stains which, on subsequently steaming the fabrics during finishing, are converted into brown or black lead sulfide; and (2) the oil is contaminated with lead which, if the fabric is not scoured, rapidly accelerates oxidation of the oil, thus producing stains of a different type.

The amount of lead required to produce such stains is extremely small. tained wool fabric was found in one case to contain 0.007% more lead on the stain than on the unstained part. When examining stains it is absolutely essential to make comparative tests on the stained and unstained portions. A sample of fine clean merino wool was found to contain 0.0009% lead, and dyes also have been found to contain lead.

Samples of Methyl Violet, which were used for tinting, contained appreciable qualities of iron and copper. When the dye was applied in neutral solution, it was found that the metal was not so readily removed by washing as was the case when the dye was applied from an acid bath and the fabric rinsed subsequently.

It must be emphasized that small traces of oils and metals in practice spread out in thin layers on the surface of wool fibers, particularly in the case of worsted yarns. Thus, there is ample opportunity for oxidation and this does occur, particularly on the outside of bundles, or on those parts of grey fabrics which are on the outside, piece ends, selvedges, etc. and the outside layers of bobbins. The inside is usually fairly well protected by its light winding and, when the temperature of storage rooms does not vary much, diffusion into the inner parts is not so marked, but there is always a slow general oxidation throughout the bulk.

It is inadvisable to leave fabrics partly exposed to air and light for any length of time. Cases come to notice where, after an examination of the dyed fabrics, it is possible with a little ingenuity to indicate the position of every window in the warehouse.

Having dealt with oil residues, it must not be forgotten that soap residues come under the same category, only in a more exaggerated form, because, through hydrolysis of soap in solution, fatty acids are deposited on the fabric, and these are on the whole more liable to oxidation than the original glycerides. With the prevalent use of drying oils for soap making, there is no limit to the development of discoloration and stains. Cottonseed, soya and linseed oils are common constituents of soaps.

False Oil Stains

Oils are often wrongly suspected as being the cause of certain stains. Sometimes very fine grit is found on yarns taken from fabrics, the size of the grit being too large to be emulsified by the scouring liquor and too small to be seen as a distinct spot. The result is that a few of these dark-colored specks distributed at fairly wide intervals along a yarn give the appearance of a dark line, and yet they give no reaction for oils, metals, etc. They can only be "spotted" by careful microscopical examination.

Fogged Yarn is another example. White yarn in particular is liable to become slightly discolored during foggy weather, when the atmosphere is laden with the products of combustion. This defect is very difficult to diagnose and is attempted usually by the process of eliminating other causes.

● GENERAL RELEASES

The General Dyestuff Corp. has released bulletins on the following products. Copies are obtainable on request.

Diazo Brown N R A Conc.—recommended by the manufacturers for its tinctorial strength and comparatively low cost. The shades produced with Beta Naphtol or Meta Toluylene Diamine are both said to be popular shades of reddish or yellowish browns respectively.

Cellitazol B N—a new form of the B brand, which, it is claimed can be applied from a soap bath whereas the older product had to be used from a hydrochloric acid bath. It is further claimed that this new product will also permit the combination with such Celliton colors as will not change in the diazotizing and developing.

Nuva B—a new product which is said to exert a most favorable influence in the kier boiling of cotton and other vegetable fibers. It is a white powder said to be easily soluble in water and the usual alkaline boiling-out liquors and does not attack the kier or its protective coating. A characteristic claimed for materials kier boiled with the addition of Nuva B is high absorbent power which is a valuable property for many articles such as towelling, surgical bandages, typewriter ribbons, etc.

Indanthrene Khaki 2GA Paste—an offering to take the place of Indanthrene Khaki 2 G Paste and is said to possess great tinctorial strength, excellent levelling properties, and excellent all around fastness. It is recommended by the manufacturers for dyeing only.

ANNUAL MEETING
AND CONVENTION
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DECEMBER 7th and 8th

CARBONIZING AND RE-DYEING WOOLEN RAGS

(Continued from page 564)

should always be done where re-dyeing of the stock is to be carried out with dyes possessing high affinity for wool in weak acid baths. Particular care should be taken to neutralize the stock when Metachrome Brown and similar one-bath browns are to be employed. If neutralizing is done imperfectly, these chrome browns yield dyeings which rub badly.

The employment of Glauber salt in the dyebath with acid colors assists penetration by retarding the adsorption of dyestuff. Similarly, a quantity of proprietary leveling compound may be used in the dye bath; in this instance, though, cost is usually a deciding factor determining the employment of the preparation.

It will be expedient, before concluding this article, to make mention of dyeing machinery in use by rag stock processing firms. When stripping and coloring thick rag stock, the best results are obtained by using open dye kettles wherein the stock is turned over by hand poling. Rotary dyeing machines of the Klauder type have proved suitable for use with rag stock excepting where stripping with strong acid has to be done, when the iron parts suffer from corrosion. To overcome this, some firms use apparatus with corrosion resisting fittings, the wooden parts being of teakwood as this timber is found to withstand bichrome and vitriol liquor better than spruce, larch and other softwoods commonly used for constructing dye kettles.

Dyeing machines employing the principle of liquor circulation through stationary stock are not very suitable for use in processing heavy grades of rag stock, especially where the stock has not been cut up into strips before reaching the dyer. With apparatus of this sort, it is found that the larger pieces of stock, such as trouser legs, portions of great coats, etc., seriously impede liquor circulation, with the result that the stock is imperfectly dyed.

Where the rag stock is cut up before dyeing, the work is done by operatives seated before revolving steel discs against which they press the material to be "ripped." The larger pieces are ripped into long narrow strips in preference to short and narrow ones, for the first named sort prove less wasteful during conversion of the stock into shoddy.

Shade sampling during dyeing of rag stock is done by the head dyer himself, as a rule, for the selection of a representative sample from a batch of vari-colored stock is not a job for unskilled persons. Before a decision as to the correctness of the shade of a batch can be determined upon, a sample of the rag stock being colored must be converted into shoddy. To do this, a miniature rag pulling machine is employed. A handful of shoddy from the machine is scoured with plenty of warm water and soap and then a comparison with the standard shade is carried out.

ROSINS, VISCOSE, ETC. IN FINISHING COTTON CLOTHS

(Continued from page 572)

Or the solutions may be coagulated, as in rayon manufacture, by treatment with dilute acid or salt solutions. Dry heat or steam will, moreover, coagulate viscose, and this method generally is more suitable for use with viscose treatment of cloth. The coagulation of viscose is attended with the formation of sulfur compounds as well as free sulfur, which are removed by subsequent treatment as in the manufacture of rayon.

Solutions of viscose can be applied either as backfilling when containing suitable minerals, or, if desired, applied alone in the mangle. One such cloth treated in the mangle has been used as a grease-proof fabric, a property acquired in part by the viscose film forming a window pane across the interstices of the cloth. This is also the basis of a patent by A. H. Kilmer (B. P. 369,430), 1931, for the preparation of a so-called acid-proof fabric for the protection of metals against acid or acid fumes. J. Huebner acquired a German patent No. 441,526 for treating a fabric with a solution of cellulose in cuprammonium, after which it is treated with dilute hydrochloric acid 2 degrees Tw. It is claimed that this solution can be padded, printed or otherwise processed as usual and that mineral or metallic fillers can be incorporated as desired.

The formation of viscose by the actual conversion of the cotton yarn into rayon has also received considerable attention. One firm several years ago spent considerable sums on the development of a process dependent on the treatment of mercerized cloth with carbon bisulfide to form viscose on the surface of the yarn. There was not much heard about the success of the process, but the firm learnt a lot about the problem of handling of carbon bisulfide.

Other solvents for cellulose have, likewise, been proposed for the same purpose. A British patent, No. 282,002, is for a treatment with caustic alkali followed by drying and subsequently with cuprammonium solution to produce a linen finish. If desired, a pattern effect can be obtained by printing one of the reagents to produce local effects.

This is apparently only an improvement of the older Willesden process of waterproofing which has been applied for some time to heavy fabrics such as ducks and canvas, which owing to their heavy construction and service requirements, are liable to mildew. This process consists of simply treating the cloth with a strong solution of copper hydroxide dissolved in ammonia solution. This solution dissolves some of the surface cellulose, and after evaporation of the ammonia, leaves the regenerated cellulose as a green lacquer on the surface of the cloth. The copper hydroxide deposited with the film inhibits the growth of moulds and fungus and is specially desirable in cloth intended for marine service.

OPEN FORUM

Rules under which this department of the REPORTER is conducted are as follows:

1. Anyone who has a technical problem on which he would like advice may submit it to the Reporter and it will be published in the first available issue.

2. Any reader who feels that he has a solution of the problem may forward his reply to us and if we feel that the reply is suitable it will be published in a succeeding issue.

3. For each such reply published the Reporter will pay a minimum of $2.

4. In case there is more than one answer to the same question, the one covering the subject in the most complete and authentic manner will be published, or if two answers are sufficiently different both will be published. If two answers are considered equally good, the one first received will be given priority.

5. The Reporter will assume no responsibility whatsoever for the accuracy of the answers submitted—it is simply offering a vehicle for the public expression of its readers' opinions.

6. Both the questioner and answerer must send in his complete name and address. When requested we will publish only the initials or other identifying insignia.

Answers

14—Can you give me any information regarding what has been done in the development of ramie for use as a textile fiber? Do you think there is any market for it and for what uses is it particularly adaptable?—R. M.

Answer No. 2.—The development of ramie as a textile fiber is clearly denoted by a few patents. French Patent No. 661,205 (January 17, 1928) protects a machine for decorticating ramie or other textile plants. The products are pressed, split longitudinally, and simultaneously most of the wood substance is removed. U. S. Patent No. 1,739,683 (December 17, 1929) involves protection for a process of treating ramie or other fibrous plants to obtain valuable by-products during the spinning process. U. S. Patent No. 1,796,718 protects a treatment of heating ramie in .1-.5% solution of $(NH_4)_2 SO_4$ at a temperature equivalent to 1-2 atmospheres for 1 or 2 hours. The material is then subjected to pressure to remove the slimy matter. U. S. Patent No. 1,796,719 involves blending ramie with rayon and spinning the blended fibers. Chemicals were employed to decorticate ramie. This process rendered the machines obsolete. Now the chemical process has been improved. A discovery, attributed to Dr. Samuel S. Eveland and the Universal Fibre Corp., eliminates sulfuric acids and removes the back and gums just as effectively. The fiber obtained by this process excells all other products made by other methods. Experts predict that this invention will hurt Europe's linen industry.

Ramie is used in novelty patterns in cotton-ramie, wool-ramie, and rayon-ramie goods. Many gas mantels and some paper is made from ramie. Decorative and upholstery fabrics are being made from ramie. Uniform and khaki materials made from ramie have exhibited excellent wearing qualities.

This fiber is treated in much the same matter as cotton. It is harder to dye than cotton, and its mercerization is done with certain precautions. These factors may limit its market possibilities.—J. E. G.

Editorial Note: While Ramie is one of the strongest fibers known, it is extremely in-elastic, will not stand torsion, or excessive and continuous bending, and loses its strength when knotted. It has been tried for many purposes, and it is conservatively estimated that more than $100,000,000 has been spent in experimenting with, and in attempting to develop the use of ramie fiber, but with practically nothing to show for it today. Its beautiful appearance when properly treated, and what are believed by the uninitiated to be its potential possibilities have lured many to sink fortunes in money and many years of valuable time in its promotion.—L. A. O.

18—We are interested in obtaining information regarding the prevention of wince marks or mill creases on worsted serges dyed by after-chrome method; weight of serges ranging from 12 to 20 ozs.

Some of the operating variables we have tried out are as follows:—Before the dyeing operation the serges have been tacked, crabbed, scoured, then crabbed again, then "set" on rolls from 10 to 24 hours. This complete operation is not now being carried out.

We have dyed pieces both tacked (face in) and untacked and in order to avoid overcrowding have dyed only two to four pieces in a six-piece dyeing kettle. We have entered the serges into water (scaife) at 90° F. and taken anywhere from 40 minutes to two hours to bring the kettle to the boil and in washing off have taken from 1½ to 2 hours to cool pieces down before removing them from the kettle. The pieces are dried immediately and do not lay around in trucks. We have varied the speed at which the pieces pass through the dyebath; we have used a flat reel and also a reel with "humps" or spreaders. We have checked the soap used in scouring and

run extraction tests on pieces before and after dyeing; also boiled the pieces in ammonia solution before dyeing.

Is this fault in the serge primarily due to the quality of stock and the setting adopted during the weaving operation as the heavier the serge and the "harder" the feel, the more easier it tends to mark. Also, we have obtained marked and unmarked serges that were dyed together in the same kettle.—**A. E. P.**

Answer.—You have taken great precaution with your process before dyeing, however I would suggest that the pieces be rolled after dyeing and allowed to stand over night.

I would advise that the cloth pass between rollers of hard rubber or steel in a water bath at about 160° F. then to the rolls and allow to stand as above.

My experience has shown me that the less complicated the process the better the fabric. I mean by this that perhaps you may be able to cut out some of the work you are now doing before the dyeing operation, by rolling the goods after dyeing. A machine similar to a jig would answer your requirements.—T. H. D.

New Question

20.—We have experienced partial color destroying action in basic color printing. The goods are folded face-to, and stored. The color destroying action is not uniform, showing bars, streaks, and blotches. When the material is baled this does not happen. Unfinished material does not show this result. No change in formulas over a period of years.—**G. O. Linberg.**

Unanswered Questions

17—We are in need of mathematical text books on problems pertaining directly to textile printing but so far have been unable to find anything on the subject. If you know of texts or problems in math. especially adapted to this field, I would more than appreciate suggestions.—**O. E. M.**

19.—In earlier editions of the Open Forum, Question No. 4, inquiry was made in regard to the use of Potassium Permanganate for certain processes of bleaching and dyeing.

Two different answers to this question were published in the May 21, 1934 edition of the DYESTUFF REPORTER. As far as I can observe, neither of these answers refer to the possible use of potassium permanganate in the bleaching of wool material and rayon. I assume that the bleaching of viscose rayon would be similar to the bleaching of cotton, but I am not sure how it would work with acetate rayon. If anyone has unsuccessfully tried to apply it for any of these purposes, I would be interested in learning why it was rejected.

Further replies along this line will be appreciated.

BOOK REVIEW

Electrokinetic Phenomena. H. A. Abramson. A. C. S. Monograph Series No. 66. Chemical Catalogue Co., New York, 1934, 316 pp. $7.50.

The author of this monograph has presented an enormous amount of experimental data and mathematical theory to the elucidation of the nature and extent of the electrical charges present on the surfaces of solid-liquid and liquid-liquid interfaces. The history, early theories and experiments, and recent theories and data serve as an introduction to the second part of the book which deals with the applications of the theory to biological practice.

To the textile chemist, most of the experimental work is of interest only by analogy since the textile fibers themselves are only slightly touched upon.

Mechanically, the book is excellent. The type is very easily read and no typographical errors were noted.

This book would be of considerable value to the advanced research worker in textile chemistry but would be of no immediate interest to the ordinary technical man.

J. H. S.

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The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

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